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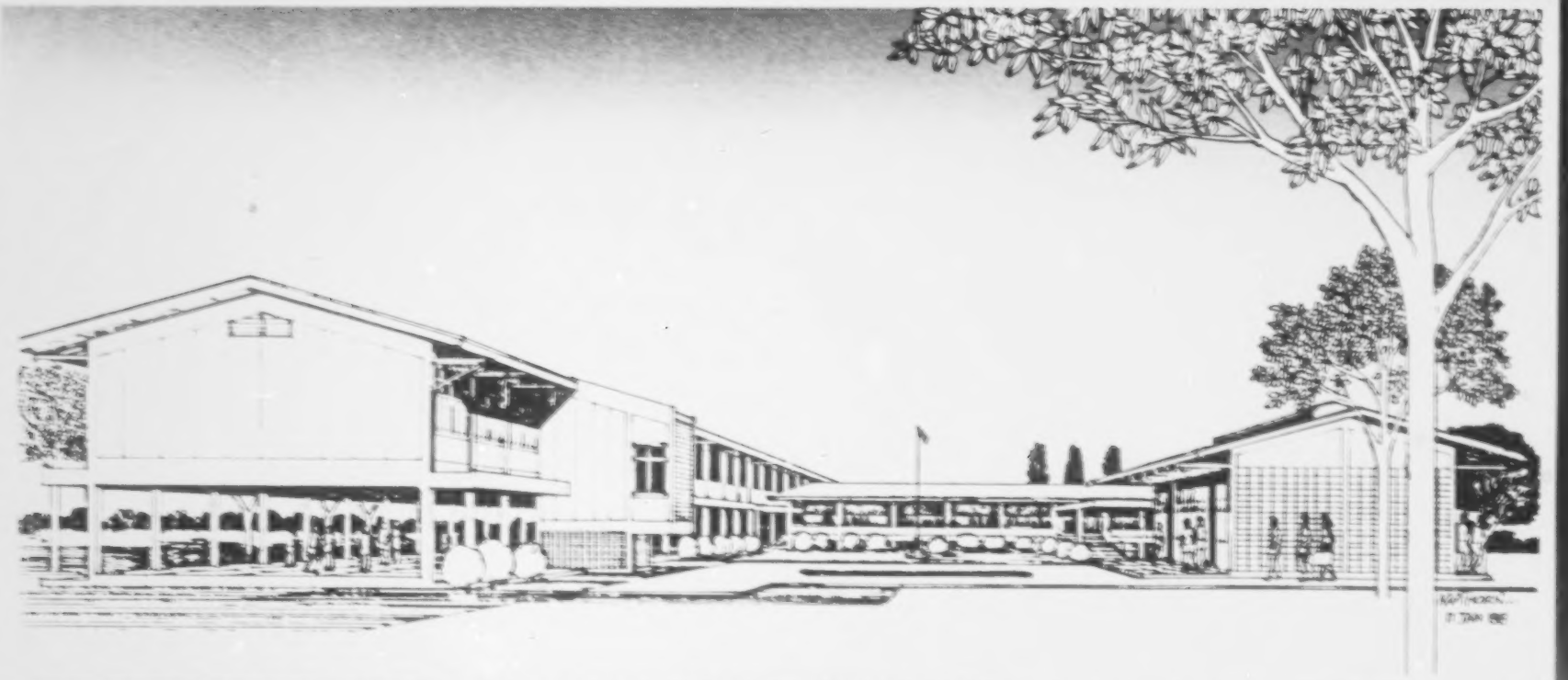
ABSTRACT

In 1987, a project was initiated in Thailand to develop a prototype to be used as a standard design for the construction of rural secondary schools in all areas of the country. The project had three objectives: (1) to derive architectural designs for classroom and auxiliary buildings that could be constructed within available budgets and would be suitable for the various geographical conditions; (2) to determine a suitable total school building size based on the optimal areas for classrooms and specialized rooms; and (3) to develop teamwork and brainstorming techniques between the many professionals and officials responsible for school development. Based on data from a survey of small-school administrators and regional supervisors as well as on ideas that emerged from a seminar held early in 1987 and attended by administrators, educators, architects, engineers, and budget officials, the report describes the design for the construction of small-sized schools with an accommodation capacity of up to 9 classes of students in a 3-3-3 enrollment pattern. The design was to be such that it could be constructed in three one-year phases on the basis of the fiscal year cycle and within a pre-determined cost ceiling. The resulting design is flexible; it can be used on a 1-1-1 or 2-2-2 enrollment pattern with the capability of later expansion and can be built according to the local topographical features and the construction skills of local workers. Construction of an actual prototype began in October 1988 and was completed in June 1989 in Uthai Thani. Various diagrams, sketches, and floor plans illustrate the text, and cost analyses for the different enrollment patterns are provided. Appendices include data on the schools in Thailand and a copy of the questionnaire used to assess existent school conditions and projected needs. (ALL)

INNOVATION IN CONSTRUCTION OF SMALL SECONDARY SCHOOLS IN THAILAND



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by *Design and Construction Division*
Department of General Education
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ABSTRACT

This report summarizes a feasibility study on the development of prototypes for secondary school buildings. This prototypes are to be used as a standard design for the construction of rural secondary schools under the Department's current development plan. The study presents the opinions of those school administrators and supervisors who responded to a questionnaire. It also presents alternatives suggested by participants in a seminar of related agencies including the Secondary School Division, the Planning Division, the Supervisory Unit and the Bureau of the Budget. The study outcome includes the design of building prototypes for three different sizes of schools, together with a suggested process for their construction and recommendations for further studies. The cost of this study was supported by Unesco.

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FOREWORD

In Thailand, the design and construction of physical facilities is one of the major problems encountered in the establishment and development of urban and rural secondary schools. Although the General Education Department has appointed a standing committee specifically to cope with this and has developed standardized approaches to design and construction, the problem remains unsolved. Resolution goes beyond the mere provision of physical facilities in relation to the needs for the establishment of new schools and improvements to existing schools, it also includes keeping up with new pedagogical and architectural developments to ensure that the facilities may optimally serve the teaching/learning process in each particular type of school. Hence, the standardized approaches to school plant design have to be updated from time to time.

This study of the development of a prototype for small secondary schools, which was undertaken by the Design and Construction Division with technical assistance from Unesco, has opened up a new dimension in the creation of secondary school buildings and environments that are conducive to better learning. This concerted effort not only provides a prototype of small schools for the Department of General Education, it also gives some design alternatives that may be applied to the whole range of medium and large-sized secondary schools in urban and rural areas.

This report illustrates how a task force approach was used to find solutions to a persistent problem, which plagues the secondary education system. The task force members developed a synergy of knowledge, experience and dedication toward the fulfillment of the objectives of the project set forth for them. I would like to congratulate them for their success, which indeed represents a milestone in school architecture in Thailand and sets a precedent for future work.

Director General
Department of General Education
March 1988

ACKNOWLEDGEMENT

This project could not have been realized without technical assistance from Unesco to whom the Department of General Education would like to express its most sincere gratitude. This support from Unesco will undoubtedly have a far-reaching effect on the architectural development of secondary schools in Thailand as well as elsewhere.

Many thanks are extended to the Unesco team whose professional and moral support provided to driving force to make this study a complete success.

PREFACE

With financial support from the Arab Gulf Programme for United Nations Development Organizations (AGFUND), Unesco has created an inter-country project known as the Development of Educational Facilities for Asia and the Pacific. The objectives of this project are to:

"Increase educational opportunity and the quality of education by providing better and more cost-effective educational facilities, in particular:

a) Improve techniques for the management of educational building programmes in order to ensure the construction of the maximum number of student places with available resources;

b) Stimulate experimentation on the creation of prototypes, the building of which is more cost-effective and makes better use of local materials, local techniques, self-help, etc.;

c) Increase awareness of the need to adequately maintain, repair and improve existing facilities and to provide the necessary financing, programming and management services;

d) Train specialists in educational buildings who are able to introduce innovations into educational building design and to apply modern management techniques to this field."

Some 17 countries from the Asia and Pacific region have expressed interest in participating in this project. In August 1985, a Programme Development Meeting was held in Chaiyaphum, Thailand in which eight countries participated: Australia, Fiji, Bhutan, Nepal, India, China and Thailand. This meeting set out the parameters by which countries could submit proposals for the support of prototypes, which would have the potential for wide-scale replication and for the training of national personnel.

In the case of Thailand, of the three country projects submitted, two were approved:

a) The development of a prototype secondary school building project;

b) Development of guidelines for the maintenance of school buildings.

Funding for these two country projects was confirmed by Unesco at a total of US$14,000. Unesco emphasized that the country projects should offer technical benefits for member countries through replication on a wide scale. It was also hoped that the projects would be of professional benefit to the project architects.

It is the policy of the Unesco project to facilitate the exchange of technical information between Member States through the preparation of reports on the accomplishments of the various prototype and training activities. This publication is a contribution to this exchange. It was written by the project staff and published by the Unesco Principal Regional Office for Asia and the Pacific.

Chapter One

ORIGINS OF THE PROJECT FOR DEVELOPMENT OF A PROTOTYPE SECONDARY SCHOOL

A. Educational policy issues

As a strategy to promote educational equality and expand educational opportunities for children in rural areas, the policy of the Department of General Education, which is spelled out in the Sixth National Economic and Social Development Plan B.E. 2530-2534 (1987-1991), foresees the establishment of 30 small-sized secondary schools per year. It envisages that these small schools will function as agents for inducing local development and improving occupational opportunities. The optimal size for the new schools was determined by analyzing the feeding capacity of the primary schools in the catchment area served by the small secondary schools, taking into account the gradually declining population resulting from an effective family planning programme. A preliminary analysis determined that the school size should include three sections each for grades VII, VIII and IX (3-3-3), totaling nine classes with a capacity of 450 students. This figure could be expanded where necessary and warranted to four sections for each grade (4-4-4) or 12 classes and a maximum capacity of 600.

B. Objectives of the project

In April 1987, the Ministry of Education launched a special project with the Unesco assistance. The project was initiated with three objectives:

1. To derive architectural designs for classroom and auxiliary buildings, which could be constructed within available budgets and would also be suitable for the various geographical conditions of the country;
2. To determine a suitable total school building size based on the optimal areas for classrooms and specialized rooms as determined by a study of the required area per student in terms of space, air ventilation, natural lighting, acoustics, durability of the buildings and safety;
3. To develop teamwork and brainstorming techniques between the many professionals and officials responsible for school development, including school administrators, financial officers, architects and engineers, and financial officers. These techniques should be applied throughout the cycle comprising prototype design, evaluation of actual prototype implementation and finalization of the standard design.

C. Target

At the outset, it was envisaged that upon completion of the prototype development study, a new prototype building design would be developed for the construction of small-sized schools with an accommodation capacity of nine classes of students in a 3-3-3 enrolment pattern. The newly developed prototype would be such that it could be constructed in three one-year phases on the basis of the fiscal year cycle. This would fit in with the growing accommodation schedule of the school, that is, three classes during the first year, six in the second and nine in the third. The architect would design the building so that a complete set of the required facilities would be available for each school year. Thus, for the first year the first three classrooms would be provided

together with the library, the administrative office and a number of necessary specialized service rooms. In subsequent years, more classrooms would be provided along with the specialized spaces required.

The standard design to be developed was intended to serve the school's instructional purposes as effectively as possible. Existing designs used by the Department of General Education were to be studied and analyzed so that their best features could be incorporated into the new designs. Also, the building structure would be simplified for ease of construction. It would be sturdy, economical, yet reasonably safe for users over the number of years in which the building is used.

D. Expected outcome

This study and analysis of architectural designs for secondary school buildings was expected to set a technical example in architecture, which in turn would provide an impetus for a continuous process of design, construction and maintenance of school facilities. There was every likelihood that the next stage of the study would involve the development of architectural designs for medium- and large-sized schools. It was the task force's hope that it would be involved in these further studies. This initial study was expected to be an important step forward in the very specialized field of school architecture, which would have a long-range positive impact on education at the secondary level and respond directly to the Department's policy as spelled out in the current National Economic and Social Development Plan.

E. Assistance from Unesco

The Department of General Education sought technical assistance from Unesco for several reasons. It needed to:

1. Obtain special funds to support a research and development project of this type;
2. Have access to the technical know-how of Unesco specialists and the technical reports published by the various member countries of Unesco;
3. Create an opportunity for exchanges of information, experience and views among project architects.

An earlier experience of working with Unesco staff indicated that the international workshops organized by Unesco are not one-shot meetings but are one activity in a series of integrated professional actions. This was particularly true for countries in Asia and the Pacific region following the Project Development Meeting organized in Thailand in 1985. Because the Unesco Principal Regional Office for Asia and the Pacific is located in Bangkok, the meeting requested that Thailand act as a centre for technical co-ordination to facilitate the exchange of information and experience among member countries. Thus, when the architects of these countries attend meetings or training courses at Unesco's regional office in Bangkok, they incorporate a visit to the Design and Construction Division into their itineraries. For instance, in 1986 the Maldives, a small country in the Indian Ocean that severely lacks information on school architecture, sought assistance from Unesco. In turn, Unesco requested the Design and Construction Division to release an architect to work with the Maldives government and to provide consultation on the development of standard criteria for school design. The results of this collaboration were published by Unesco in 1986.

Although the Unesco funding provided for Thailand to undertake the present study is modest, the support behind it is conducive to creating a broader and more extensive development of school architecture for this region.

Chapter Two

PROJECT IMPLEMENTATION

A. Task forces

To manage the project, the Department of General Education appointed two task forces, one at the departmental level and the other at the divisional level.

At the departmental level, the task force comprised a Deputy Director General of the Department, who served as Chairman, and the representatives of concerned divisions as members. This task force was responsible for formulating policy guidelines concerning the optimal number of classes, budget requirements, budget requisition and selection of a site for the construction of the prototype school.

The divisional task force comprised the entire staff of the Design and Construction Division. It was responsible for planning, preparing the summary report, designing the building, supervising the construction work and co-ordinating the work to its completion.

The two task forces commenced project implementation in June 1987 and expected to complete it by March 1988. Some problems were encountered during the project implementation, due in part to the task force's lack of prior experience with this type of externally funded project. A delay of approximately two months occurred and, consequently, the project work as a whole fell behind schedule.

B. Data collection

The divisional task force drew up a plan to collect and process data in the following manner:

1. A questionnaire was sent to the administrators of small-sized schools, who are the users of such educational buildings, to obtain analytical information on the different types of existing facilities, their advantages and disadvantages and their suggestions for building improvements;
2. Another questionnaire was sent to regional supervisors in their capacity as educators and experts in the various subject fields to obtain detailed information on the use of specialized areas and service rooms. This information was to be used in developing details for the architectural design of the prototype building;
3. A group of architects and engineers was sent out by the task force to interview a sample of building users and observe the conditions of existing buildings after different periods of use. They solicited information on the previous construction systems, and construction materials. This enabled the task force to prepare the details for the construction of the prototype more adequately;
4. After completing the data collection phase, a 'dummy' or preliminary design was prepared;
5. The task force presented the problems and 'dummy' design in a seminar, which was attended by representatives of such concerned agencies as the Bureau of the Budget and certain divisions in the Department of General Education. The purpose of the seminar was to elicit the views and ideas of the participants, which could then be translated into architectural designs for the prototype school.

C. Suggestions from Unesco

Once the preliminary design had been developed, the task force forwarded it to Unesco for further comments. Unesco made it possible for architects from countries that were also implementing their own projects, including Bangladesh, Philippines, Nepal and Bhutan, to give their views. This in-depth study and exchange of experiences generated many ideas for further development.

D. Applying the data

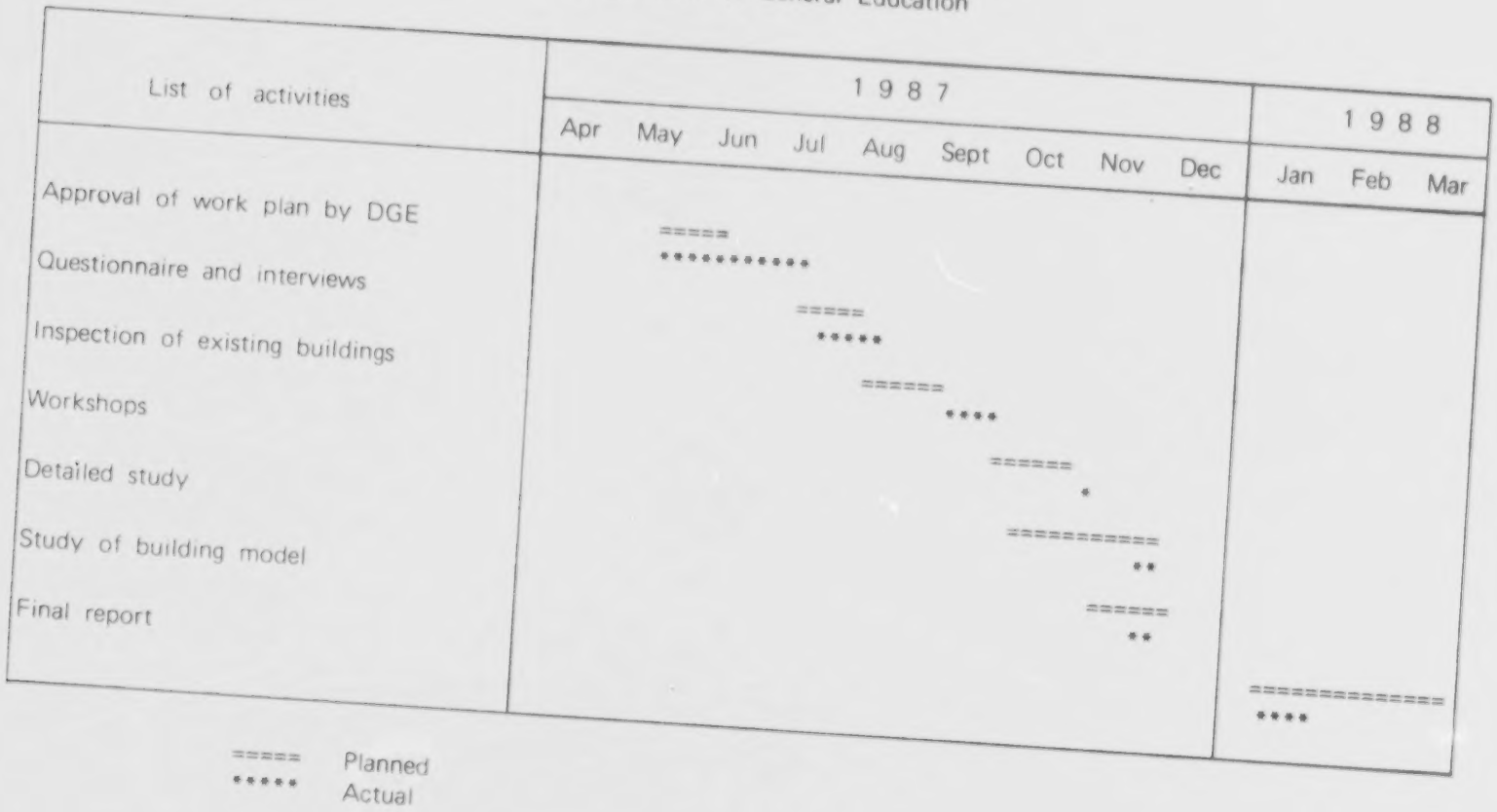
On the basis of the views derived from the seminar and the comments obtained, the task force proceeded to develop a design for a prototype school, which was to be built within a pre-determined cost ceiling. This was prepared for submission to regular line authorities including the Bureau of the Budget for endorsement. Once this step was completed, the divisional task force proceeded to prepare the architectural drawings, structural designs, construction detailing and cost estimations for prototype building. The Department of General Education designated Sutham Witaya School in Uthai Thani as the pilot site.

E. Development of the prototype

When construction of the prototype has been completed and the students and teachers have moved in, the Department of General Education will appoint a working group to evaluate the new building while it is in use. Upon conclusion of the working group's evaluation, its findings will be used to develop a standard prototype design for further replication. When the revised prototype design is approved for use as the standard design for further applications, the study on the prototype of small-sized secondary schools will have completed its cycle. It is expected that 30 new schools will be built each year following final approval of the new standard design.

Figure 1 shows the implementation plan of the project.

Figure 1. Implementation plan
Thailand prototype Secondary School Project
Department of General Education



Chapter Three

EXISTING BUILDINGS

A. The origins of existing buildings

At the time the study began, several standard designs for small-sized secondary schools were in existence, some of which had been in use for more than ten years. Two main types of standard design existed:

1. Standard designs under regular budget fundings;
2. Standard designs under the World Bank financing scheme.

These two designs differed slightly to meet the requirements of the funding source. The standard designs under the World Bank loan had to conform to the standard criteria set forth by the office of the Prime Minister and to certain requirements of the World Bank.

In Thailand, new designs are normally developed to replace older ones and are not maintained longer than five years, which is the period of each successive National Economic and Social Development Plan. Generally speaking, differences in the designs reflect policy changes at different times, e.g., increasing class size and the introduction of new construction technologies.

A notable change occurred after 1978, when the Department of General Education adopted a newly developed diversified curriculum with a wider range of occupational choices. To meet the requirements and provisions of the new curriculum, new buildings had to include specialized areas such as art rooms and service rooms. The requirements for auxiliary facilities also increased accordingly.

To evaluate the use of existing classroom and auxiliary buildings, questionnaires were sent to 85 small schools and to 12 supervisory units in the regional education offices. This was done so that the strengths and advantages of the previous designs could be retained and incorporated into the newly developed prototype design. From the architect's viewpoint, this evaluation was necessary because not only should the new designs improve the school environment, but school architecture should be developed to have a long-range impact on the overall development of the remote communities served by the school.

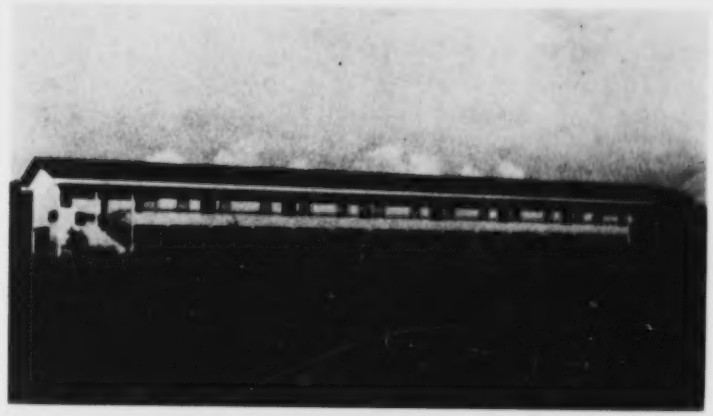


Figure 2. Type 108L classroom block

B. Suggestions from users on how to improve existing buildings

Most administrators were generally satisfied with the standard buildings provided for their small-sized schools, but

they did suggest some improvements:

1. Natural lighting should be improved for some types of buildings, because electricity is not available in all schools;
2. Students' desks and chairs should be re-designed and made sturdier;
3. Some buildings in the south are adversely affected by rain which enters through the openings provided for natural illumination;

Figure 3. Type 216C classroom block

4. Some of the buildings do not provide student benches or seats along the corridor;
5. Many administrators were not satisfied with the shutter panels made from asbestos sheets because they are easy to break;
6. Noise transmission levels between classes are excessively high within some buildings because of ineffective partitioning;
7. Polished cement floors required by the Bureau of the budget are difficult to maintain because they tend to crack and break up;
8. The Type 102/27 building has natural illumination openings, which attract birds that leave droppings on the floor;
9. The tool cabinets in the workshop are too small to hold all of the tools;
10. Some types of workshops have fixed metal grills outside the fixed glazing, which make it difficult to keep the glass clean;
11. The roof structures of some workshops bend upward and have weakened;
12. The Type 102/27 building has natural illumination openings in the gables, which should be covered or shaded because they let in the east or west sun;
13. Because small-sized schools are located in remote rural areas, security measures should be tightened up by strengthening the doors and windows;
14. For buildings constructed near the sea, those with metal structures have quickly deteriorated;
15. The workshops should be separated from other spaces to prevent noise interference while the students are in class;
16. Walls made from concrete blocks are not strong enough. Sinks that are attached to this type of wall tend to come loose. Brick walls would be stronger.

These suggestions were well-received by the task force, especially the remarks concerning the construction of buildings near the sea coast and on islands. As the next step, the task force decided to send a group of technicians to study the problems and to make suggestions for the use of suitable materials and proper details for standard building designs. For those building types that the Department of General Education intends to retain, the task force sent architects to study the problems in the existing building plans and to further modify the standard design.

Figure 4. Type 316L classroom block

C. Suggestions for the improvement of building administration

Opinions concerning the policy on physical facilities management received through the questionnaires brought forth some suggestions that may prove useful in developing processes for site selection and in the design and construction of secondary schools. The suggestions are summarized as follows:

1. Is it possible to modify existing standard building designs to suit local climates and cultures? Can there be different solutions for mountainous areas, coastal areas, the central plain, etc.? ;
2. There is an apparent difference between a large-sized and a small-sized school in that the latter has no choice but to make use of the standard design, whereas the former enjoys a custom-made design that is more extravagant. If the standard design could be simplified and made economical for small-medium- and large-sized schools simultaneously, this would have many advantages including increased economies and functional and aesthetic compatibility between buildings in the school complex;
3. There is a need for a shower room where students can change into their sports suits or working uniforms;

Figure 5. Type CS 217 classroom block

4. Almost all respondents felt there was a need for an audiovisual room in all schools regardless of size;
5. What may be done to reduce the amount of time that school administrators spend on building construction and site development. Most of them are fully occupied with their regular work and have to make special efforts to follow-up on budget requisitions, blueprints, supervision of construction, etc.;
6. The habitual three-year phasing of the construction of a single building results in differences in workmanship, finish and levels of different parts of the building. If phasing is unavoidable, the architect should divide the building into three distinctive

parts that can be joined together without interrupting the instructional programme;

7. Building development should take into account that large schools are more flexible financially, both in terms of budget availability and the ability to collect sizable tuition fees, whereas small schools are limited in both, (some of the questionnaire respondents went so far as to allege that it is common practice for schools to vie with each other in requesting funds in the manner that "whoever has longer arms can pick more fruit");
8. Schools in the south where the rainfall is heavy need to have covered passageways between the various parts of the building to enable students to move about;
9. It would be convenient to have a furnished guidance room incorporated into the standard design;
10. Because some schools frequently run out of safe water in the dry season, it would be very helpful to allocate funds for the construction of water reservoirs with a holding capacity proportionate to the total number of students;
11. A common flaw in the standard design is that it provides only standard classrooms, which have to be modified by the schools themselves to create spaces for the business office, the principal's office, the first-aid room, etc. It would be much more suitable to have plans for these special-purpose rooms incorporated into the standard design;
12. Land acquired through donations by private individuals or groups tends to require some exceptional measures such as land filling or has other problems i.e., in water supply or power installation, which prove to be much more costly than expected;
13. Workshops should be as completely furnished as those in World Bank project schools.

These comments and suggestions were well-received by the task force and were presented at a seminar for consideration. The views given by the seminar participants, who were senior administrators of the department, representatives of the Bureau of Budget, secondary school administrators, supervisors, architects and engineers, were summarized and submitted to the department for policy consideration.

D. Existing building designs

The existing standard building designs shown in this report are intended for small schools built to serve a single tambon, which is an administrative grouping of approximately ten villages. These standard designs may be described as follows:

1. **Type 108 L.** This type of building design is a little more than three years old. It was favoured by users when it was first introduced because it reflected the architect's appreciation of local architecture. However, after a few years of use complaints have arisen that natural illumination is inadequate and instruction is being interrupted when there is heavy rain. This is especially true for those schools with no access to electrical power mains;
2. **Type 216 C.** This type of architecture seems to be the best adapted to small-sized schools as it is more common than any other type. According to some users, an apparent advantage of this design is that its ground floor is an open area, which has been enclosed by some schools and converted into a library unit or business office. The Type 216 C building has 16 classrooms, but is divisible into three construction phases, the first of which consists of six classrooms. After one year has elapsed and enrol-

ment has increased, another six classrooms can be constructed. The final four classrooms are normally finished off after another year or two. This phased construction approach was followed by the task force to develop a self-contained building design that can be implemented in three phases. At the same time, the new design is more manageable for the school administrator and staff;

3. **Type 316 L.** This is a newer version of 216 C with a light structure proposed by engineers. Although this building technology poses some problems during construction, most administrators have been satisfied with the buildings after a period of use;

4. **Type CS 217.** This is the standard design used solely for the 480 student schools in the Lower Secondary School Project assisted by the World Bank. It has been influenced by the World Bank's criteria restricting the area of the corridors to no more than 30 per cent of the total area of the building. Thus, all areas inside the building are utilized including the space underneath the staircase, where the teachers' toilet is located. An evaluation of the use of this design indicated that the school administrators were very satisfied with this type of building, particularly because it includes specifically designed specialized rooms such as the library, the science laboratory and the arts room. This design marks the first time that such rooms have been provided for tambon schools. One of the suggestions made by the schools is to provide benches along the corridor. These were excluded from the original design agreed upon by the Bank.

Chapter Four

THE CONCEPT: SUGGESTIONS BY THE SEMINAR

The seminar held in early December 1987 and attended by administrators, educators, architects, engineers and budget officials, who were concerned with school development, crystallized the project. In so doing, a number of the earlier hypotheses were questioned and original new ideas emerged.

The seminar first reconsidered the architectural design for small schools, evaluating whether the design not only facilitates secondary school teaching/learning activities but also functions as an education centre for the community at large. This became an additional factor in determining building suitability both in terms of architectural design and constructional procedures.

It was agreed that the laterally expandable, match-box type of design should be abolished. Instead, it was suggested at one point that the expansion be an upward extension of the existing building, such that in the first stage eight classrooms would be constructed on the ground floor. If a 16-room building was needed at a later stage, another eight classrooms could be built on top of the first eight. If budget availability was a major constraint, then only six classrooms could be constructed in the first phase. If a complex of buildings was preferred, covered connections could create a unified environment to nurture self-learning and relaxation between teaching sessions. Another suggestion was that the design include a reduced number of standard classrooms along with several special-purpose rooms including a library, science laboratories, art education room and workshop. The students would then be required to move from one room to another according to the school's master timetable, thus giving a high rate of utilization for all teaching spaces.

The seminar observed that in Thailand, small secondary schools of a three classroom size with an enrolment not exceeding 135 pupils are the most suitable for rural areas near the borders, for maritime islands and for some remote hill-tribe communities. It went on to point out that for other types of communities, larger schools of six to nine classrooms with capacities of between 270 and 450 students would be suitable, depending on the size of the community cluster that forms the tambon or sub-district. (The assumption here is that each class of children would have its own classroom).

The meeting recognized that the average cost per student tends to be higher for the construction of a small school than for a large school. The architects were advised, therefore to use durable materials that would last for 30 years or more and, in that way would reduce the average annual capital cost over the lifetime of the building.

The disadvantages of small-sized schools, both in terms of staffing and recurrent costs, were fully realized for the first time at the seminar. It was noted that these particular problems could make small secondary schools less viable than middle- and large-sized schools. Small schools collect fewer school fees and there are not enough successful alumni to provide voluntary financial support to the schools.

The nature of vocational courses is the part of the curriculum that most affects school building design. As part of the government's rural development policy, students are given an opportunity to take occupational subjects related to agriculture or cottage industry. In line with this, participants at the seminar felt that a series of specialized shops for each

unit, such as agriculture, would be more suitable than general industrial arts shops. At the outset, the meeting had ambitious requirements but these were reduced when it came time to prepare budget estimates within the budget feasibility established by the representatives of the Bureau of budget. As a result, the specialized unit shop idea was replaced by a general shop with separate cabinets containing the tools for different subjects. It was proposed that bulky agricultural implements, be kept at the students' houses or left on the agricultural plot behind the school. This approach should prove useful given careful time-tabling of classes and teacher rotations.

The teaching of occupational subjects not only acquaints students with the foundations of these subjects, it also enables them to compare different subjects in the same field, so that they may ascertain their aptitudes and decide on those areas that will best enable them to develop their full potential. One of the most notable features of the general shop is that it teaches students how to look after the building, the machines and the different types of teaching materials. This knowledge and experience becomes additionally useful at home.

A. Needs of small-sized schools

A statistical survey of secondary schools showed that there was a total of 1,715 such schools in Thailand, comprising:

	Size of school	Number of schools
Extra large:	61 classrooms or more	61
Large:	42-60 classrooms	309
	27-41 classrooms	220
Medium:	18-26 classrooms	153
Small:	10-17 classrooms	339
	less than 10 classrooms	633

The report showed that the number of large- and medium-sized schools had not risen over the last 15 years as a result of successful family planning programmes. On the other hand, even though some 30 primary schools are being converted to lower-cycle secondary schools each year, there is still a strong demand for new nine-classroom schools at the village level. The seminar noted that these new schools need to be designed with complete facilities, including a business office, principal's office, guidance room and first aid room, none of which have ever been incorporated into the design of small-sized schools. To privide instruction and community services, it was stated that the schools should be built all in one phase instead of three which was previously a common practice necessitated by budgetary constraints.

B. Frequency of room utilization

Small secondary schools cater to the first three-year cycle of secondary classes, that is, to Grades VII, VIII and IX (M1, 2, and 3 in Thailand's education terminology), for 35 periods per class per week. In accordance with the policy of the Department of General Education, the standard utilization factors for the various types of rooms.

Type of room	Approximate number of periods/week
Regular classroom	28
Science laboratory	30
Workshop	30
Agriculture workshop (including outside plots)	35
Electives	24

C. Area requirements

Square metre requirement for 3-3-3 school with seating capacity for 450 students as fixed by the seminar:

Rooms	Space requirement (sq. m.)
Classrooms (six at 64 sq.m. each)	384
Service rooms	
Principal and assistant	64
Business, finance, procurement	64
Academic, evaluation and supplies	64
Guidance and first aid	64
Sub Total	256
Specialized rooms	
Library	96
Science laboratory	96
Sports assembly	96
Corridor, stairway, teachers' toilet	290
Sub Total	578
Cafeteria *cum* auditorium	500
General shop	192
Total area required	1,910
Area per student	4.24

D. Conclusion of area requirements

From the data given above, the following needs of small schools were summarized by the seminar:

1. The building should be self-contained and cater to the needs of nine, six and three classroom schools, respectively. The buildings for the smallest schools should be expandable to accommodate greater enrolments that is, the three-classroom building should be expandable to six-classrooms and six classrooms expandable to nine;
2. Buildings for all three sizes of schools should include standard classrooms, specialized rooms and workshops as necessary, while the match-box type of building should be abandoned;
3. All parts of the building complex should be joined together. Due consideration should be given not only to the site on which the building is to be constructed but also the usability of its exterior. For example, shaded outdoor spaces may also be used for self-study and other activities.
4. The building should not be taller than two stories to increase its adaptability to topographical conditions, which vary from place to place;
5. The construction system used for the schools should be the most beneficial one possible. It should allow for a variety of room arrangements, and yet should also be economical.

A table of future space requirements was prepared as shown in Figure 6.

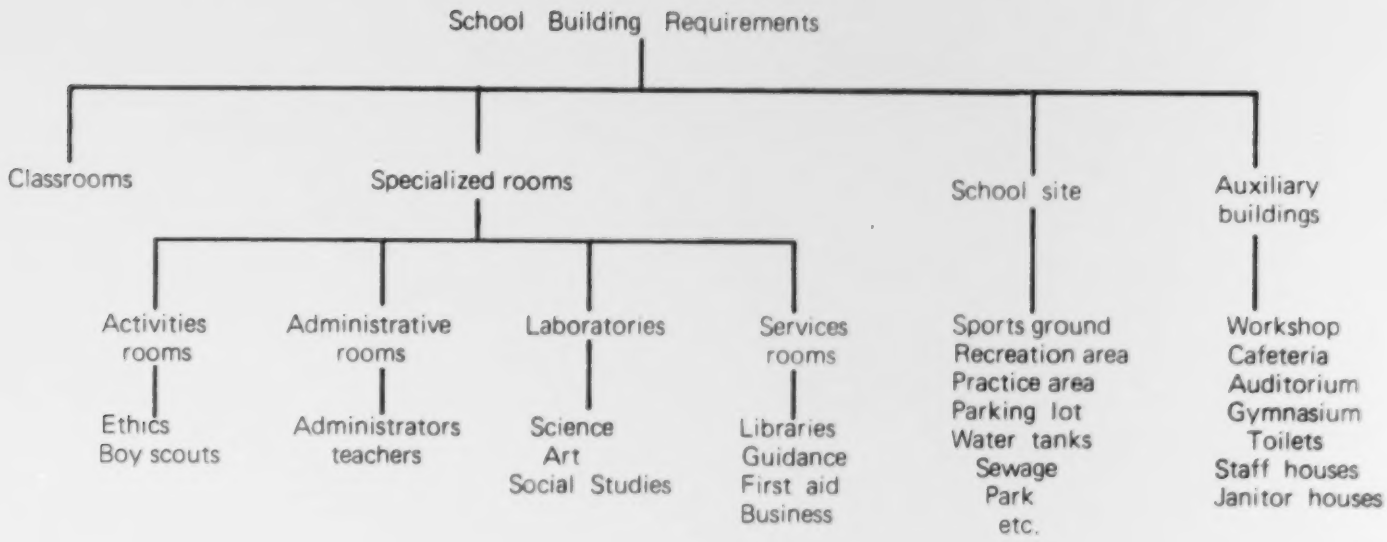


Figure 6. Grouping of space types

E. Preliminary design

During the initial stage of the study, the task force prepared a preliminary or 'dummy' design as a model against which the existing standard designs could be analyzed and which could be further developed and refined into a completely new prototype design. This preliminary design was then presented to the representatives of concerned divisions to obtain an independent set of reactions. In this way, the task force was able to derive useful ideas that contributed to the further shaping of the prototype design, which was later scrutinized by the seminar and endorsed by all of the individuals concerned.

The preliminary design is shown in Figures 7 through 9.

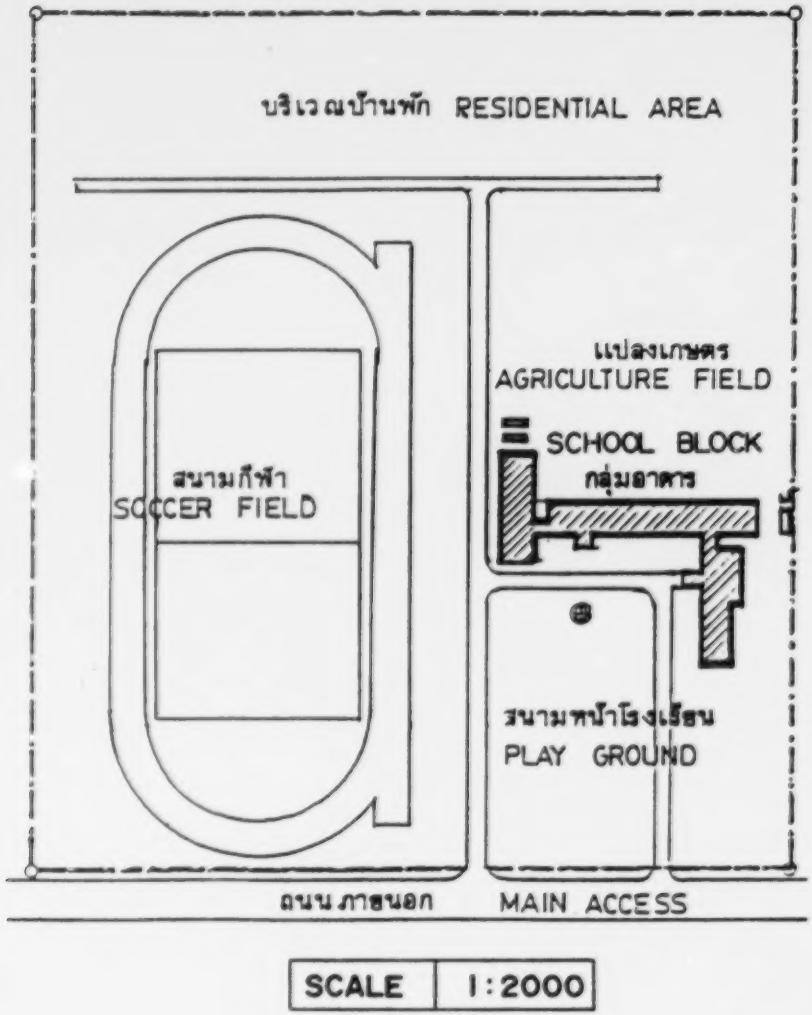


Figure 7. Preliminary design: site plan

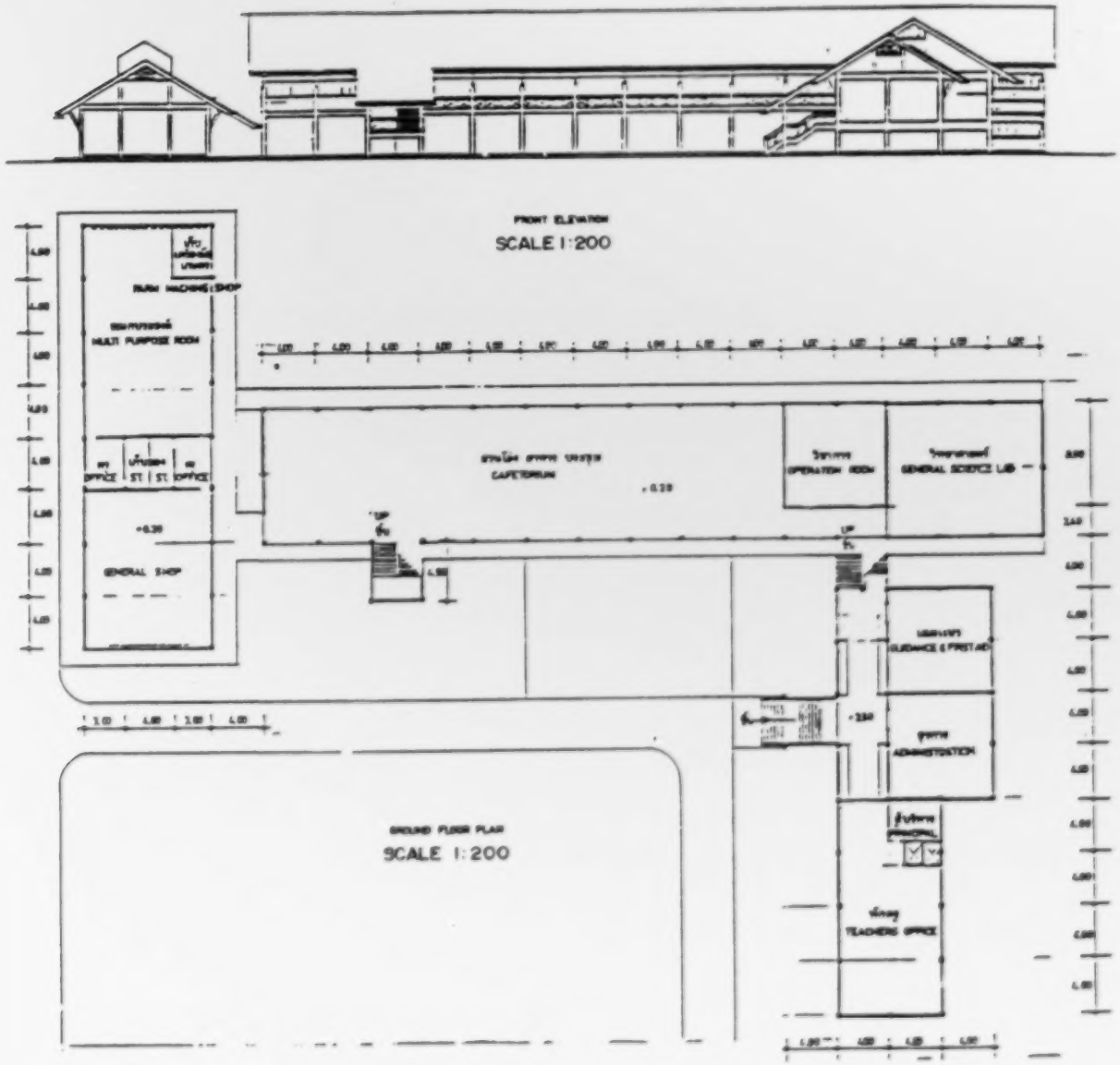


Figure 8. Preliminary design: ground floor plan

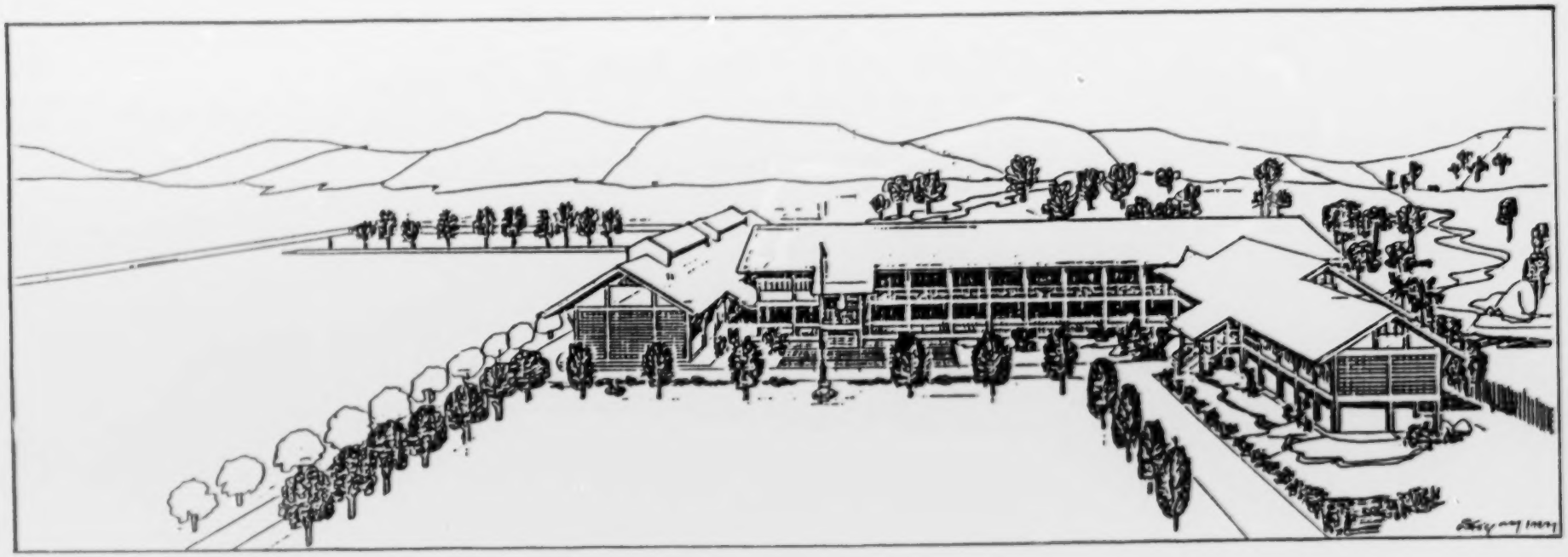


Figure 9. Preliminary design: perspective

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Chapter Five
THE PROTOTYPE

A. Basic parametres

On the basis of the study findings and recommendations of the seminar, the task force proceeded to develop a prototype design that catered to the needs and requirements of the secondary school curriculum and, at the same time, met special the needs of small-sized community schools.

On the basis of the seminar's premise that the budget for rural schools should be determined in accordance with the phased releasing of resources under the National Economic and Social Development Plan and also be adequate for a school of any size to offer a full educational programme, the "school within the school" concept was derived. The task force recognized that schools were needed for enrolment patterns of 1-1-1 and 2-2-2 as well as 3-3-3. Furthermore, increasing enrolments needed to be considered. Thus, designs were required for three different school sizes. These designs needed to be prepared in such a way that a 1-1-1 school could be designed with a full complement of facilities, yet could be expanded, when needed, into a 2-2-2 school in a second construction phase and on into a 3-3-3 in a third.

The accommodation schedule for the initial stage of construction was based on 150 students in a 1-1-1 pattern and provided complete administrative and instructional facilities. These facilities were to be accommodated in a single building. The accommodation schedule for the second construction phase was based on expansion to 300 students in a 2-2-2 pattern. This could be accommodated by adding a second building and adjusting a portion of the light-weight partitioning of the first building. Likewise, in the third phase of expansion for 450 students a third building could be constructed and light-weight partitioning in the first two buildings further adjusted. Of course, as the school grows supplementary equipment should be provided according to enrolment.

B. Room requirements

The calculation of the number of classrooms, specialized rooms and auxiliary rooms was based on the optimum enrolment for each school size. This formula was used by the department for the 480-student capacity schools constructed under the Lower Secondary School Project, funded by the World Bank, and was evaluated after actual application.

By rotating students between regular classrooms and specialized rooms such as the science laboratory and general shop, rooms are used more efficiently. Thanks to this technique, it was found that general classrooms were required for only two-thirds of the total number of student groups. The time-tables for each school term are drawn up to obtain a high utilization of the facilities provided. The capabilities of the school administrator and his staff are challenged, because the timetable has to incorporate all variables including classes, groups, teachers and available spaces.

C. Building layout

One of the suggestions made at the seminar was that a covered corridor should join all parts of the building. This would enable teaching materials and equipment to be moved from room to room without undue exposure to the weather. Also, students would avoid having to walk in the rain. A U-shape design was found to be the most suitable and efficient for meeting this requirement. The design avoids the expense of long corridors linking different buildings and creates an

open area within the building, which can accommodate a diversity of activities such as sports, student meetings and morning assemblies in front of the flag pole.

There are many advantages in leaving a major part of the ground floor unenclosed for use as a multi-purpose cafeteria *cum* auditorium (cafetorium). Providing a spacious open area not only gives an open feeling to the school by allowing people to see through the building but also provides a space to be used by the students for recreation, relaxation and indoor games. Finally, the multi-purpose auditorium could also be used for community activities such as exhibitions of farm produce or cultural performances.

D. Building design

Large areas of the building may be partitioned into a number of cells with the use of light materials. In this way, partitions may be moved when necessary. For example, the principal and administrative cells may be located in an area equivalent to the size of two classrooms, but may be subdivided to provide the principals office, administrative guidance room, first aid, room, and staff meeting room. In the design, the administrative room is located in the central zone of the complex and features a low-top counter for contact with visitors from outside the school.

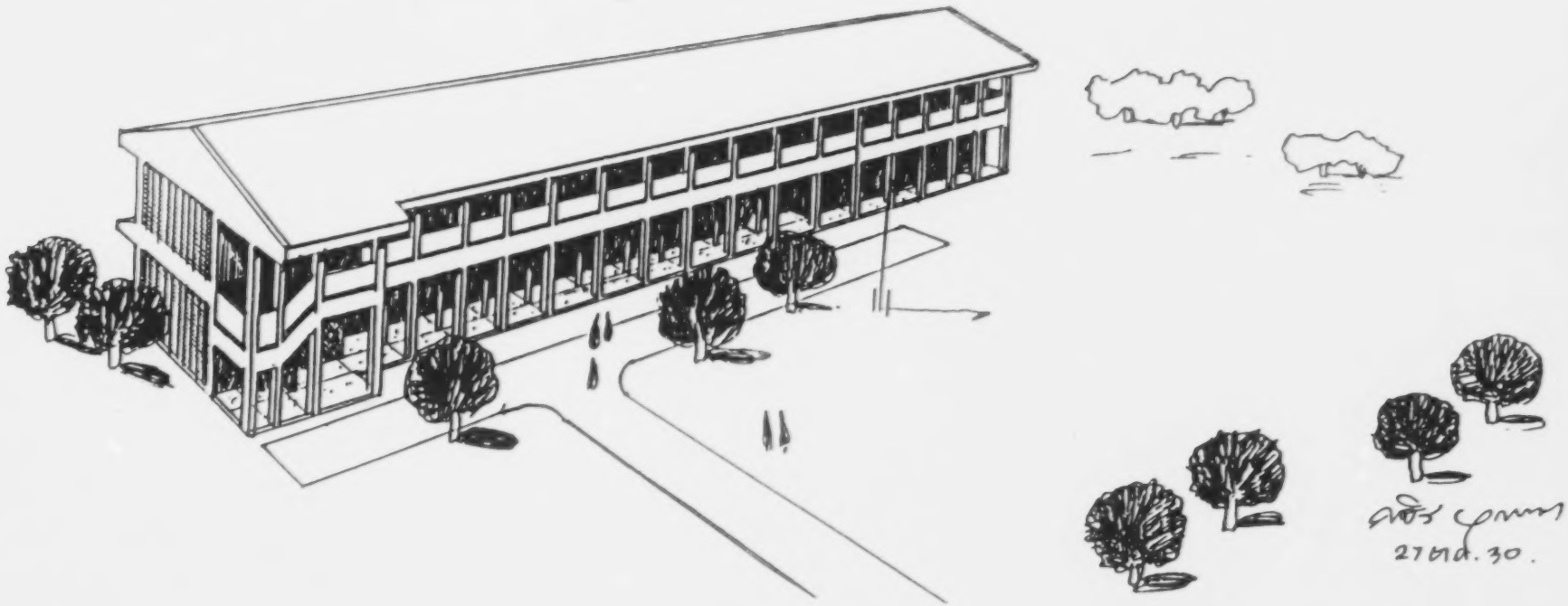
The workshop is separate from the main building to reduce noise interference with adjacent classes, but this does not affect the original principle of having all parts of the building joined together to form a single buildings complex. The workshop itself is a wide, open hall, which can accommodate the industrial arts courses offered at the lower secondary school level. Built into the shop are storage rooms, tool cabinets and the teacher's room, because the task force realized that work education and occupational subjects need a different type of accommodation than other courses.

E. Classroom design

In determining the standard classroom size, the task force advocated an 8 x 8 square metre room rather than the commonly used 7 x 9 square metre space. This takes into consideration the effective sight distance of the average student, especially those who sit at the rear of the classroom, as well as the acceptable audibility of the teacher's voice as suggested by Unesco. Other advantages of this classroom configuration are a gain of 1 square metre in usable space inside each classroom and a 2 square metre reduction in the corridor area outside of each classroom.

F. Features of the prototype

Figures 10 through 15 and tables 1 through 3 present the architectural designs, are analysis and cost targets for each of the three school sizes. Features of the three prototypes were derived on the basis of the concepts described above; they are classified as Type A (1-1-1), Type B (2-2-2) and Type C (3-3-3). As landscaping is to be based on local topographical factors, the master plan layout for each school should take into account the local site conditions. Building elevations may also be adopted to reflect regional architectural characteristics.



Type A (1-1-1)

The sketch shows the smallest type of building and auxiliary facilities. With a seating capacity between 90 to 150 students, it may be constructed on the border and in mountainous areas, where there is a need for permanent classrooms but where student enrolment is rather small. The total area of the classroom building is approximately 1,322 square metres and the estimated total cost is around 3,600,000 Baht ($144,000).

Figure 10. Prototype design Type A: perspective

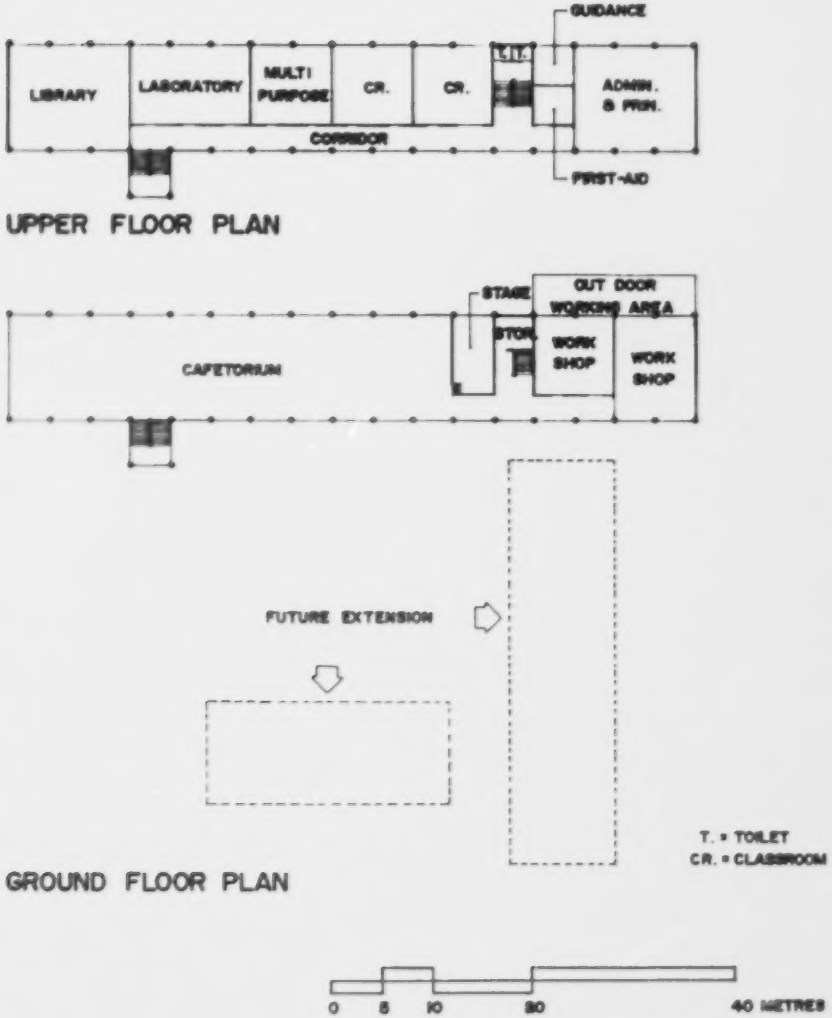
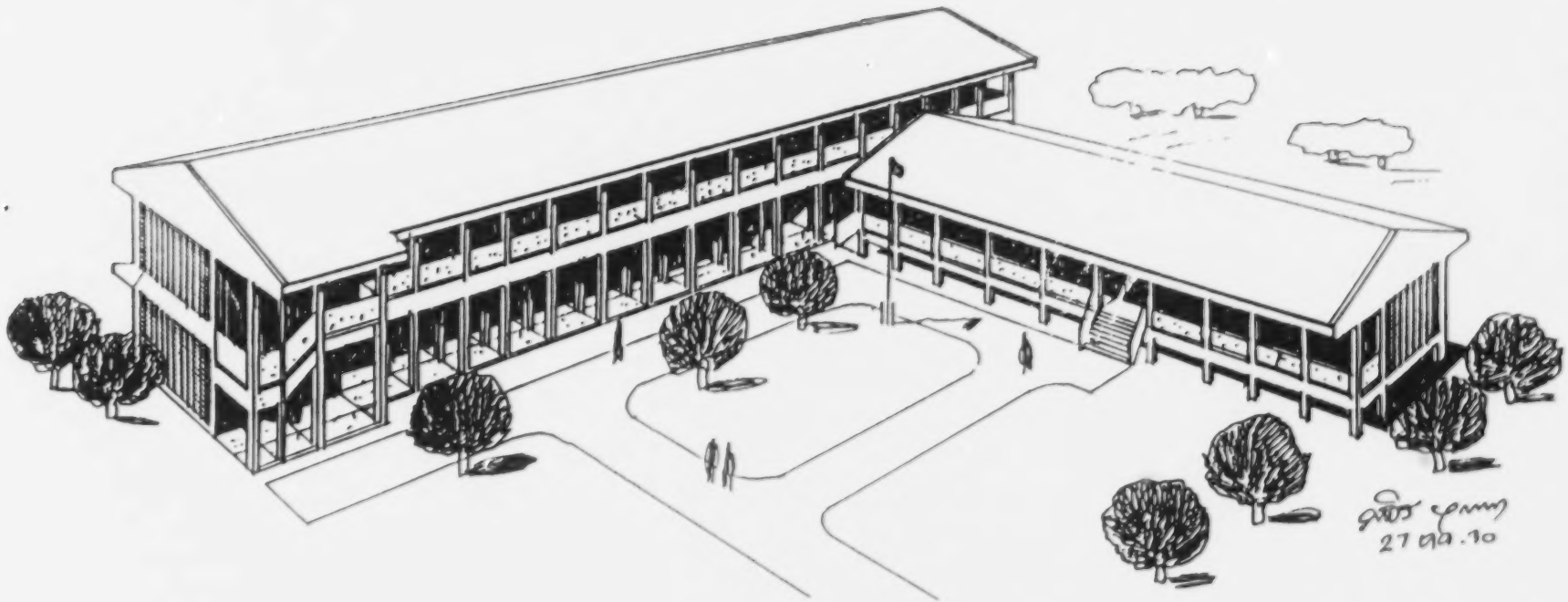


Figure 11. Prototype design Type A: floor plans

Table 1. Area and cost analysis of secondary school prototype Type A (1-1-1) 90 - 150 Pupils

Schedule of accommodation	
1. Classroom building	
2 classrooms	128 sq.m.
Principal and administration	124.8 sq.m.
Guidance and first aid	32 sq.m.
Library	124.8 sq.m.
Laboratory	96 sq.m.
Multi-purpose room	64 sq.m.
Circulation and toilets	238.4 sq.m.
Total area	808 sq.m.
Estimated cost: $120 per sq.m.	$ 96,960
2. Cafetorium (ground floor)	499.2 sq.m.
Estimated cost: $60 per sq.m.	$ 29,952
3. Workshop (2 units)	147.2 sq.m.
Estimated cost: $120 per sq.m.	$ 17,664
Total area	1,454.4 sq.m.
Area per student	9.47 sq.m.
Cost of buildings 1 + 2 + 3 =	$144,576
Approximate total cost	$145,000



Type B (2-2-2)

The sketch shows a medium-sized building and auxiliary facilities, having a seating capacity between 180 to 300 students. It is not considered justifiable to construct a complete building block in a single fiscal year, as the total student enrolment will surpass the threshold of 150 only in the following fiscal year. For this reason, it will take two fiscal years to complete a total area of 1,871 square metres at a total cost of around 4,850,000 Baht ($194,000).

Figure 12. Prototype design Type B: perspective

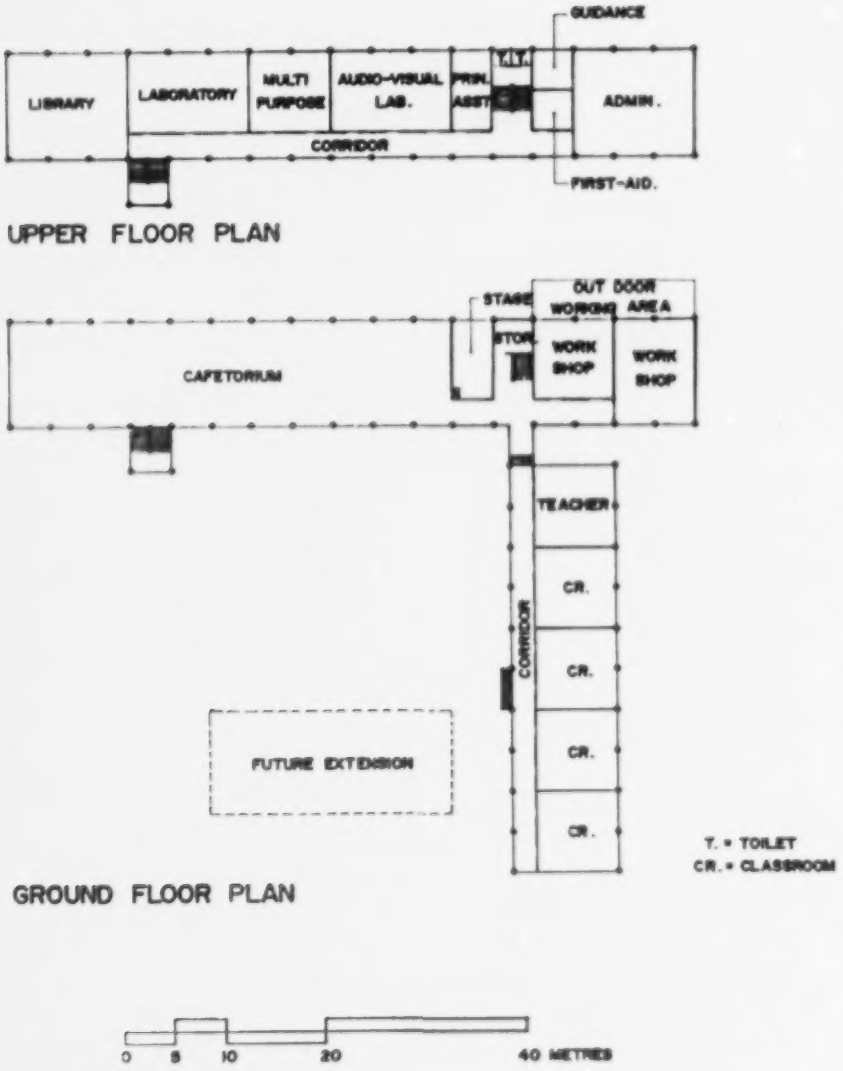
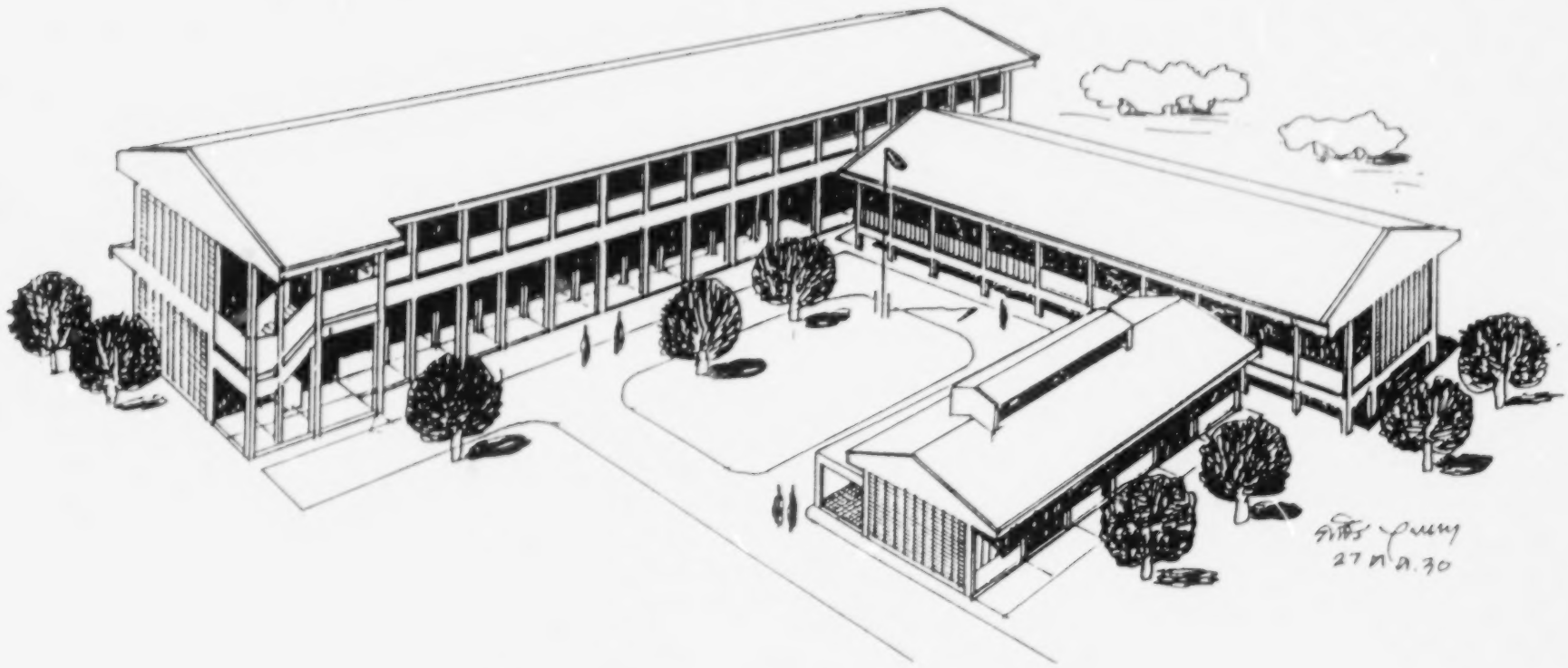


Figure 13. Prototype design Type B: floor plans

Table 2. Area and cost analysis of secondary school prototype Type B (2-2-2) 180 - 300 pupils

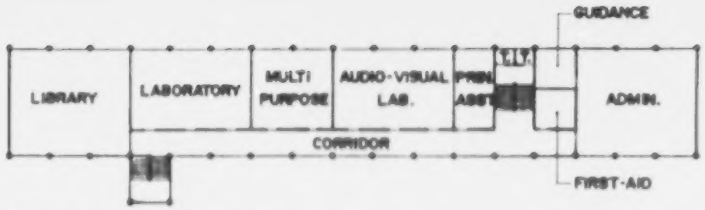
Schedule of accommodation		
1. Classroom building		
4 classrooms	256	sq.m.
Principal and assistant	32	sq.m.
Administration	124.8	sq.m.
Guidance and first aid	32	sq.m.
Teacher room	64	sq.m.
Library	124.8	sq.m.
Laboratory	96	sq.m.
Multi-purpose room	64	sq.m.
Audio-visual lab	96	sq.m.
Circulation and toilets	334.4	sq.m.
Total area	1,224	sq.m.
Estimated cost: $120 per sq.m.	$146,880	
2. Cafetorium (ground floor)	499.2	sq.m.
Estimated cost: $60 per sq.m.	$ 29,952	
3. Workshop (2 units)	147.2	sq.m.
Estimated cost: $120 per sq.m.	$ 17,664	
Total area	1,870.4	sq.m.
Area per student	6.23	sq.m.
Cost of buildings 1 + 2 + 3 =	$194,496	
Approximate total cost	$194,000	



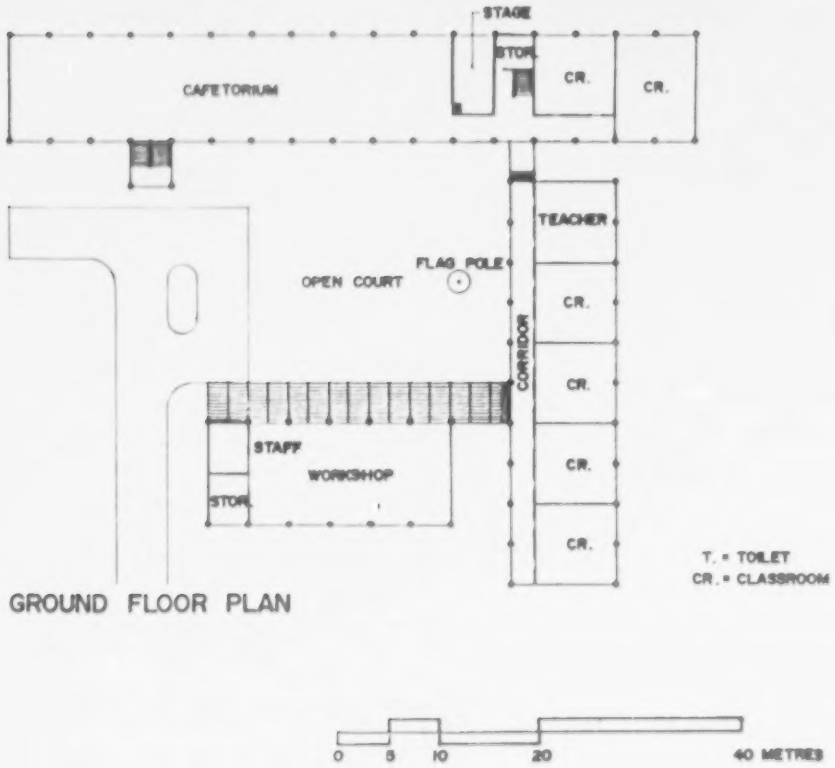
Type C (3-3-3)

The sketch shows the largest type of building with auxiliary facilities for small schools. According to the current plan, 30 new secondary schools are needed each year at the tambon level with a total enrolment of 360 to 450 per school. The budget allocation would include the cost of furniture installation, site development, water supply and electricity installation if the construction were carried out as a complete package within one fiscal year. Alternatively, a Type B school may be expanded into a Type C design during one fiscal year. The total area to be constructed is approximately 2,111 square metres and the total cost will be about 5,500,000 Baht ($222,000).

Figure 14. Prototype design Type C. perspective



UPPER FLOOR PLAN



GROUND FLOOR PLAN

Figure 15. Prototype design Type C: floor plans

Table 3. Area and cost analysis of secondary school Prototype Type C (3-3-3) 360 - 450 pupils

Schedule of accommodation		
1. Classroom building		
6 classrooms	403.2	sq.m.
Principal and assistant	32	sq.m.
Administration	124.8	sq.m.
Guidance and first aid	32	sq.m.
Teacher room	64	sq.m.
Library	124.8	sq.m.
Laboratory	96	sq.m.
Multi-purpose room	64	sq.m.
Audio-visual lab	96	sq.m.
Circulation and toilets	334.4	sq.m.
Total area	1,371.2	sq.m.
Estimated cost: $120 per sq.m.	$164,544	
2. Cafetorium (ground floor)	499.2	sq.m.
Estimated cost: $60 per sq.m.	$ 29,952	
3. Workshop	240	sq.m.
Estimated cost: $120 per sq.m.	$ 28,800	
Total area	2,110.4	sq.m.
Area per student	4.69	sq.m.
Cost of buildings 1 + 2 + 3 =	$223,296	
Approximate total cost	$223,000	

(Note: This data may be compared to the area requirements established by the seminar found in Chapter Four, Part C).

Chapter Six

MATERIALS AND CONSTRUCTION SYSTEM

The task force, which included architects, engineers and other concerned professionals, held regular meetings to develop guidelines for the construction system and, finally, to determine the list of materials most suited to the rural sites on which the schools would be constructed. As the terrain and manpower levels in Thailand differs from region to region, the use of locally available materials and the technical skills of local technicians and workers must be considered. This being said, it was the task force's contention that the industrial standards stipulated in the Government's standing regulations must be followed. These required that the building structure be based upon the metric system of measurement in line with the objective of standardizing local products. To facilitate construction work and price control, the task force considered the quality, availability and price of locally produced materials. It also took into account the problems typically encountered in the construction of rural secondary schools, particularly the lack of skilled labour and the topographical conditions in rural areas. The construction system used in the prototype school is based on semi-prefabrication. The main structure is to be cast *in situ* while other components, such as the roof truss, doors, and windows are manufactured in a plant and brought to the site for installation. This design was expected to result in a sturdy building that can be speedily constructed with effective cost controls which meets the standards set by the Bureau of Budget.

Alternative materials may be used for buildings that are to be constructed in areas with unusual geographical conditions, such as coastal areas or islands in the Gulf of Thailand. Other local variations are also allowed. For instance, some schools may use precast concrete panels for flooring while others may use *in situ* concrete flooring. The latter is recommended for places where the transportation of certain parts creates problems that must be circumvented and where the costs of prefabricated components are expected to be high.

This construction approach meets the four requirements set forth by the task force:

1. The construction materials and the building system must be suitable for the structure of secondary schools. The building must be both durable and expandable at a later date;
2. The building system must be suitable for the construction of classrooms, science laboratories, libraries and other specialized rooms in the school;
3. The interior of the building should be highly adaptable to permit easy renovation and modification;
4. It should be possible to carry out the maintenance and supervision of the building at a nominal cost.

A. Building specifications

The building specifications are given below:

1. **Main structure** – Cast-in-place reinforced concrete structure with the floor level and foundation design adjustable to suit local soil conditions. The reinforced concrete work will include the staircase, corridor and sunshade slab, thus adding to the strength of the overall structure;
2. **Outer walls** – Cement blocks are to be used that conform to the government policy on forest conservation and the reduced use of bricks. Outer walls are to be painted or sand-blasted. The faces of the walls are to be sealed to prevent water leakage;
3. **Roofing** – Corrugated asbestos sheets size 0.50 x

1.20 metres are to be laid on top of factory-made roof trusses, such that rain water can be collected and used for drinking purposes. Thus, all buildings should have gutters;

4. **Inner partitions** – Light, ready-made materials are attached to chromed metal frames. Such screens are easy to move and yet absorb the noises that might travel between adjacent rooms;
5. **Ceiling** – Use ready-made materials, such as gypsum boards or any other light ceiling materials. Use T-shape, metal frames hung from the metal-roof truss;
6. **Flooring** – Use ready-made cement pads or precast concrete in accordance with engineering specifications, then surface it with polished stones or rubber surfaces to help control echoes;
7. **Electricity** – The lighting system must provide adequate illumination during rain storms or at twilight. The power metres should be installed separately, one for each building in order to control the use of electricity. A wiring system for buzzers and an intercom system are included to facilitate administration of the school;
8. **Doors and windows** – Use metal frames for windows and wooden frames for doors, so as to conform to the government policy countering deforestation;
9. **Sewage** – Only the teachers' toilets are to be provided with a double tank system composed of a resting tank and disposal tank. For other toilets, the waste water will empty into the resting tank and then be piped to the main sewage system;
10. **Building equipment** – A water pump is necessary to pump water up to the toilets. Fire extinguishers are to be installed in every building.

The construction system is based on a minimum requirement of 1.00 sq.m. x 1.00 sq.m. as the unit of measurement for the width and length of rooms, with due consideration given to building components that are factory ready-made and can be installed right away. Examples of these are the roof trusses, doors, windows and inner walls.

It is necessary for the superstructure to be constructed on site, such that it will be convenient for the contractor to transport materials to the site. The use of an ***in situ*** concrete structure ensures the strength and sturdiness of the building in line with the engineering requirements. An additional reason is that, as was found in the study, rural construction workers are very familiar with this method. Therefore, the construction of the foundation, columns, major and minor beams is to be carried out using ***in situ*** concrete casting.

Other parts of the building such as the walls, the roof truss, the door frames and the window frames can be built from ready-made materials to reduce construction time and ensure good workmanship by local workers.

In certain locations where transportation is not a problem, precast concrete can be used to help speed up the installation process. The use of precast concrete block also has the added advantaged of being lighter than ***in situ*** concrete work, thus reducing the overall weight of the building.

The outer walls are to be made from precast concrete blocks, which are produced by local factories in large quantities and are easy to lay using unsophisticated skills.

B. Construction plan

The construction procedure suggested would make it possible to reduce the construction period by 30 days over the time normally required to complete a two-story building and auxiliary facilities with a total area of 2,110 square metres (normal time required is 270 days). The diagram in Figure 16 depicts the time frame for the new construction approach.

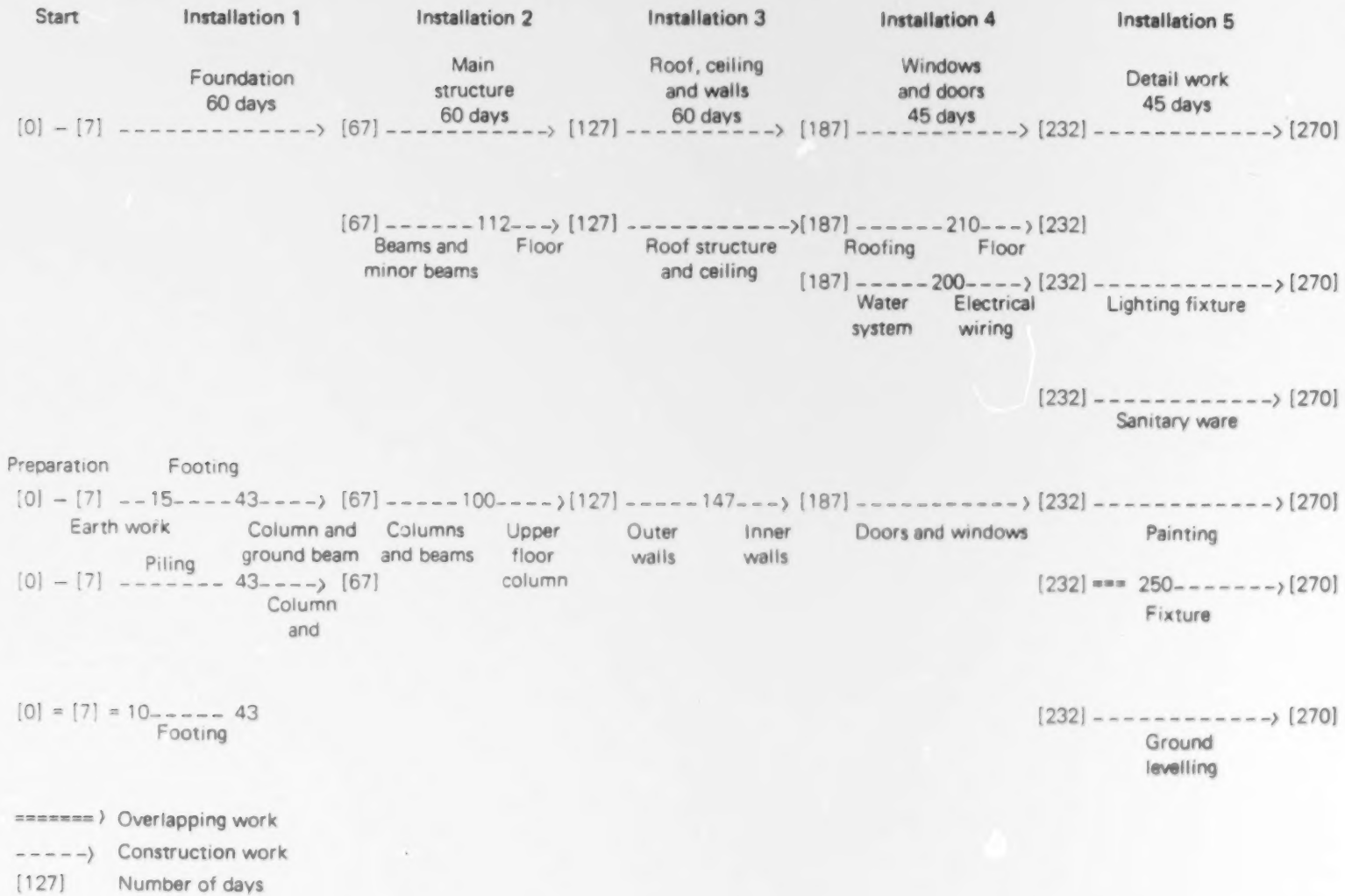
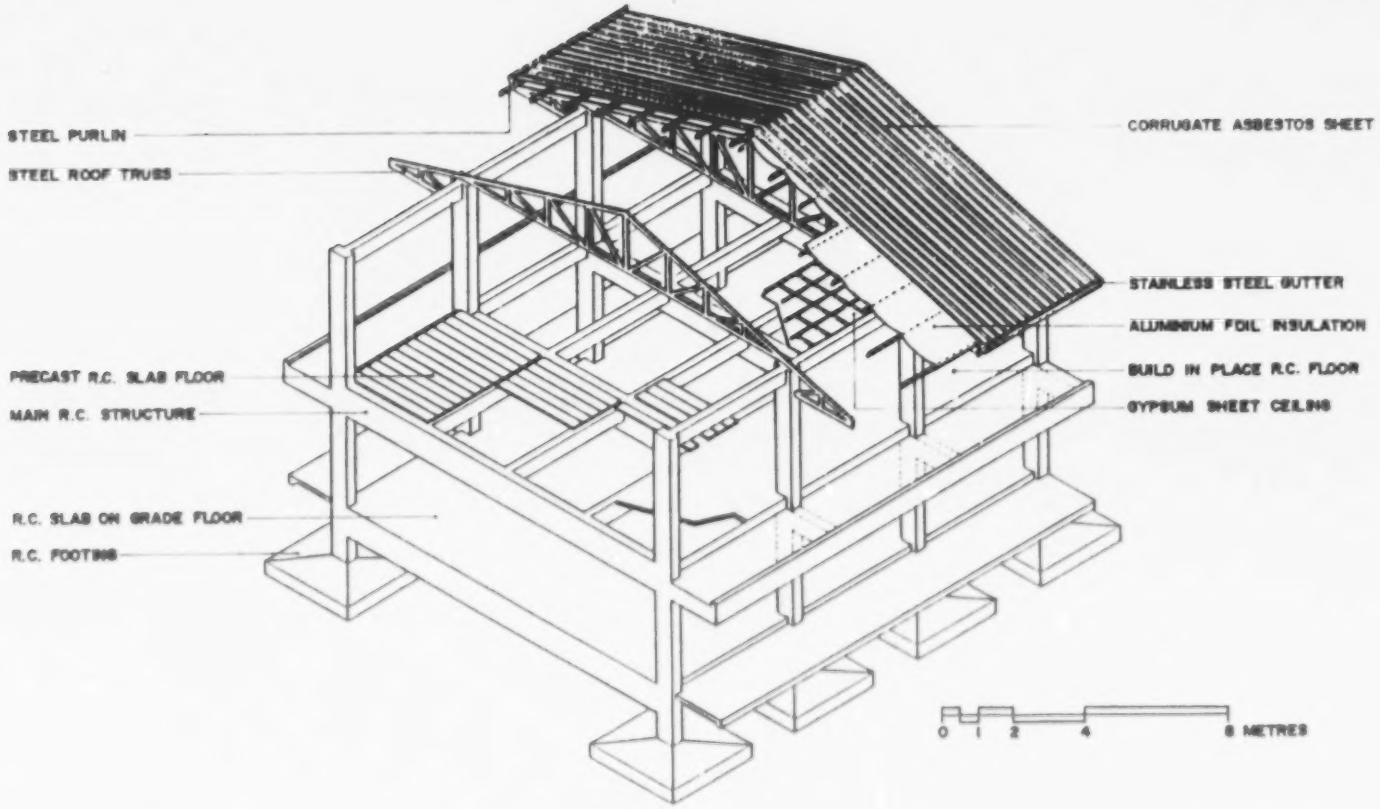
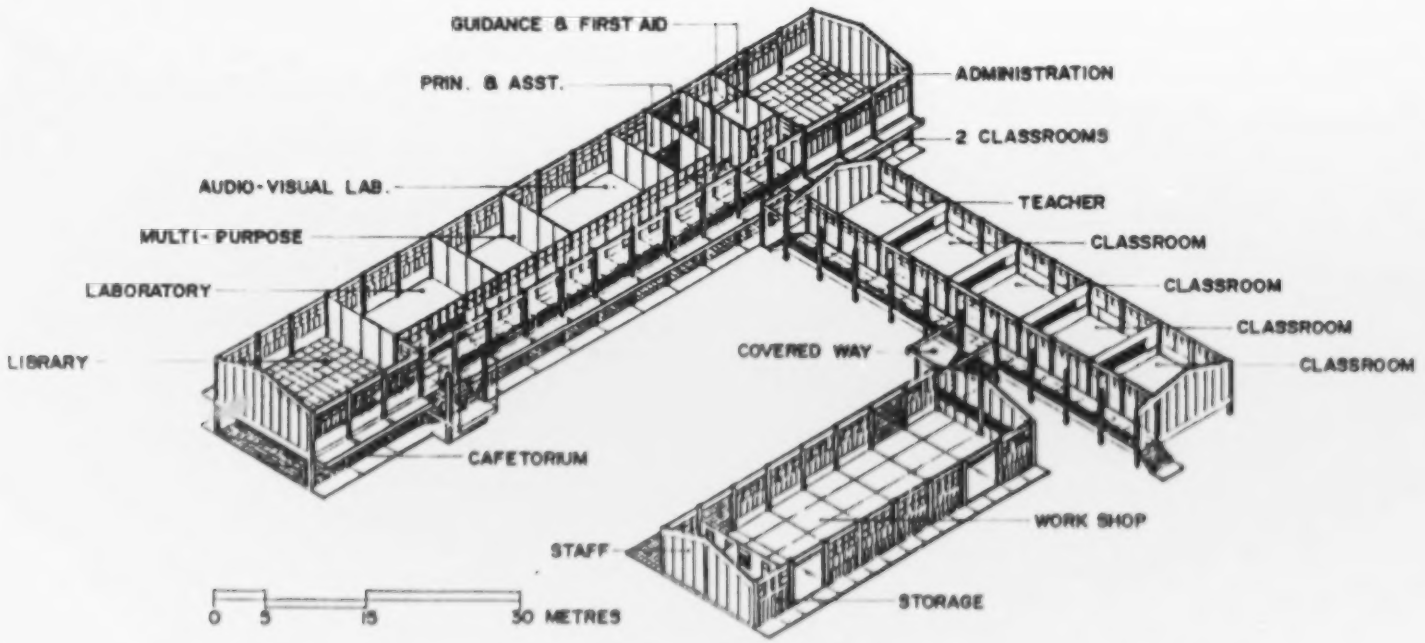


Figure 16. Critical path diagram for construction



Isometric drawing showing the main structure of the building with footings, columns, beams, floors, roof structure and corrugated asbestos roofing. This structure is considered suitable for Thailand where 65 per cent of the schools do not require pilings and where broad concrete footings are adequate. A choice is given between precast and in situ flooring as deemed suitable for the specific school location. The metal rod truss is ready-made in factories to ensure that the steel used conforms to industrial standards. The ceiling should be made from light materials, such as asbestos cement sheets.

Figure 17. Prototype design: isometric of construction system



Isometric drawing showing how buildings are joined together to form a building block consisting of classrooms, specialized rooms, administrative units and a general shop. These rooms and units are joined together to facilitate student flow when they change classes as well as the transportation of instructional materials and equipment from one room to another.

Figure 18. Prototype design Type C: cut-away isometric

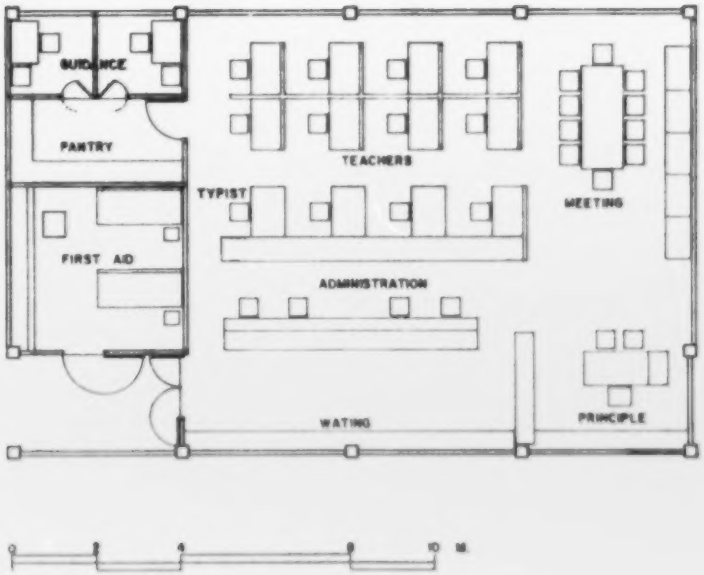
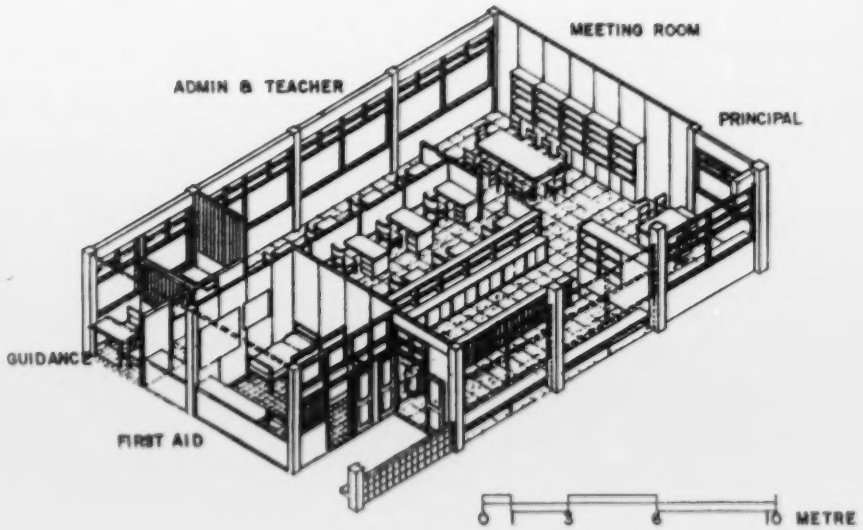


Figure 19. Prototype design: floor plan of administration



Isometric drawing showing the administrative area. The space in the middle serves as the school's administrative centre consisting of the principal's office, the assistant principal's office, a small staff meeting room, a guidance room, a first aid room and a general staff room. The inner partitioning walls are made of light materials that can be moved for future rearrangements.

Figure 20. Prototype design: isometric of administration

Chapter Seven

THE PROTOTYPE AT SUTHAM WITTAYA SCHOOL, UTHAI THANI

A. Area selection

The Department of General Education chose Sutham Witaya School, Uthai Thani as the pilot site for the prototype building. It's selection was based on the fact that this school, which was originally located on the premises of Wat Thasung in 1984, had to be moved to a new site to enable it to cope with an increasing student enrolment, which could not be accommodated at the present site due to restricted area. Expansion was justified by a rising trend in the number of primary school leavers continuing on to attend secondary schools in the Muang District. The plan was to expand the Sutham Witaya School to nine classes within the period of the Sixth National Economic and Social Development Plan covering 1987-1991 inclusive.

Other factors also played a role in the decision. The enthusiasm of the Provincial Secondary Education Committee was demonstrated when it acquired the land. Furthermore, the school site is close to town, thus making it convenient to supervise the construction work and follow up on its results.

B. Site

The site is located in the tourist centre of the province, about 500 metres from the provincial town centre. It belongs to Wat Sangkat Ratanagiri and has a total area of about 11 rai (17,600 sq.m.), excluding the hillside in the rear of the site, which can be used for construction of teacher houses, for an agricultural plot and as a student recreation area. The front side is adjacent to Thachang Road, while the back looks up Sakae Krang Hill. The west side borders the temple and the east side lies next to the Provincial Land Reform Office.

Because the site is located in a provincial town, there were few site development problems other than providing tap water and electricity supplies for the workshop. What remained to be done was to allocate some funds to the school for the installation of a water system and a higher-capacity transformer to replace the old one, previsously owned by the former primary school. Land filling was unnecessary, but ground levelling was required. One apparent advantage of the site was that a sizable sum could be saved on the foundation as piling was not necessary, unlike those schools constructed near river banks.

The site location in the provincial town was expected to help induce a rapid growth in student enrolment as the nearest secondary school is more than three kilometres away. Another advantage is the likelihood of the school being supported simultaneously by the monastery and the community.

Construction of the prototype school for a 3-3-3 enrolment pattern and capacity of 450 students began in October 1988 and will be completed in June 1989. An evaluation will be carried out, the results of which will be used to further modify the prototype design. The results will be communicated to Unesco and other interested agencies.

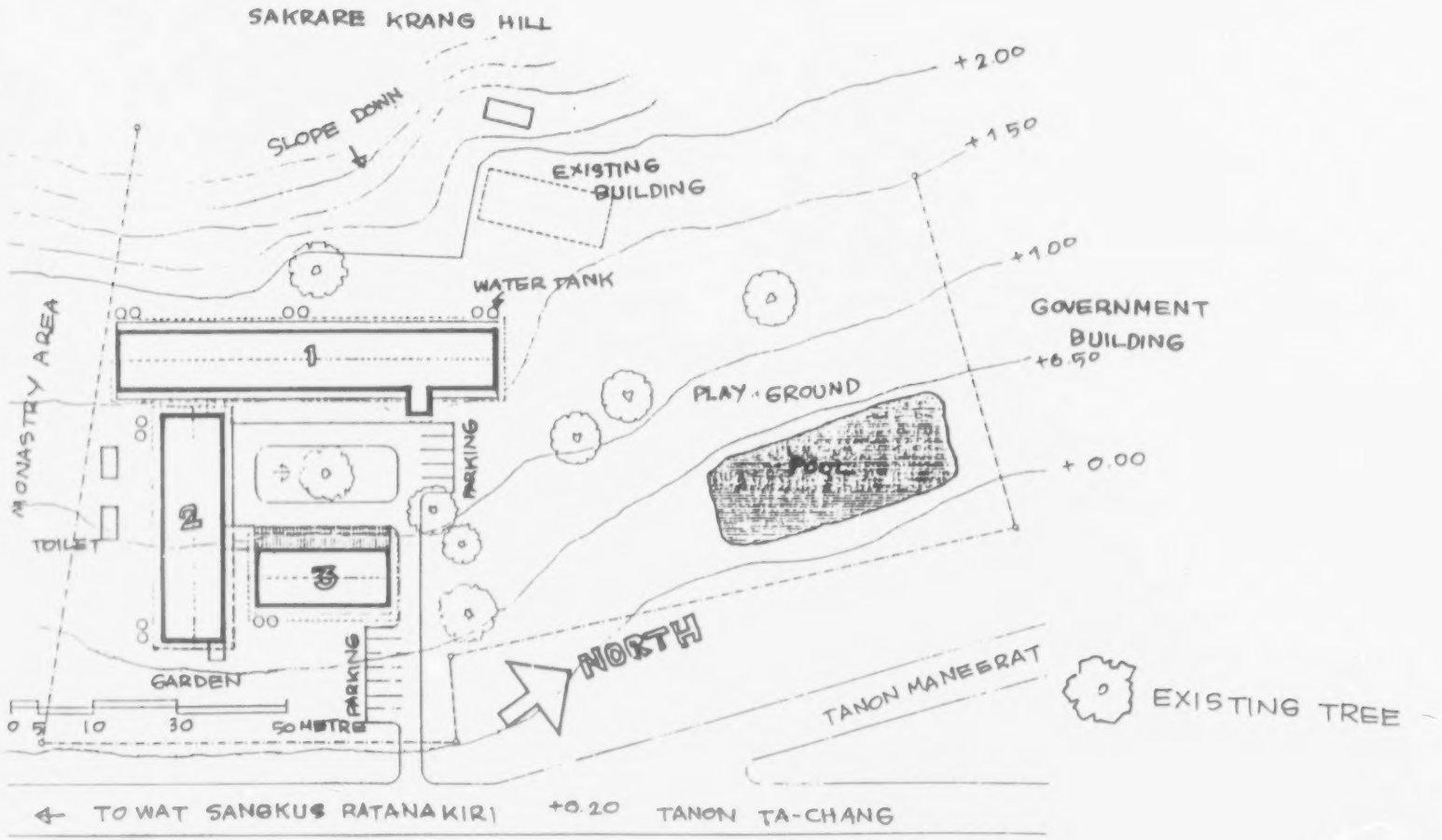


Figure 21. Sutham village schools: master plan

Figure 22. Photograph of site

Figure 23. The task force members at the site

Chapter Eight

SUMMARY AND CONCLUSION

This exercise marks the first time that the Design and Construction Division of the Department of General Education has been charged with preparing a study of a prototype secondary school using technical and financial assistance from an international funding agency. Because other prototype projects were being implemented simultaneously in other countries in Asia and the Pacific, this study not only explored the suitability of standard buildings for secondary schools in the Thai setting, it also promoted an exchange of views and experiences among the architects in various member countries having similar needs and problems.

A look at the task force's notes since its inception in June 1987 shows a vast number of written views and suggestions from the members themselves, from respondents to questionnaires, from seminar participants, from direct experiences with other projects and from foreign colleagues, who visited the project from time to time. The amount of information gathered became so monumental some could not be documented in this report.

The task force arrived at a general consensus that while some of the suggestions were obviously useful for the present and others could possibly be useful in the future, they should all be presented in this report in as much as they could be analyzed and compiled. The task force is grateful to those who expressed their views willingly and made straight forward suggestions straight forward.

Below are some of the main suggestions noted by the task force, which have proven useful for the project and may also be relevant for further studies.

A. Comments and suggestions concerning the learning environment

1. The architectural design of schools should be functional and should enable students and teachers to live and work together with dignity and happiness during that one-third of their daily life, which is spent in school.
2. The school should be in a position to facilitate all activities, e.g., administration, as well as teaching and learning, including evening community services offered as functional education classes organized by the Department of Non-formal Education.
3. The school should play a key role in the students' mental development process by providing them with facilities and an environment conducive to their further development within the surroundings of their own community.
4. The school should play a key role in the development of social cohesiveness and community spirit, including the preservation of the traditions and cultural heritage of the nation.

B. Administrative comments and recommendations

1. The construction approach should be oriented toward creating a complete building (with various-sized rooms) rather than a match-box type structure having uniform classroom-sized rooms.
2. The budget allocation formula should be based on cost per square metre rather than on the number of

classrooms. This is necessary because the newly developed prototype comprises specialized rooms of varying dimensions as required by the nature of the school activities.

3. When the standard design is used, not only should the foundation and floor level be adjusted to suit local soil conditions the design itself should also be modified to suit local requirements such as factors pertaining to coastal locations.
4. Existing buildings should be remodeled to convert regular classrooms into specialized rooms with the proper dimensions as required by the school.
5. Investment in small-sized schools was found to be proportionately higher than that for larger-sized schools when calculated on the basis of 30 years of building utilization. This is because their basic service facilities requirements (a major factor in initial cost outlays) were essentially identical.
6. Connections between different buildings are necessary not only for schools in the South where rainfall is heavy, but in any part of the country. This will enable instructional materials and equipment to be safely moved around from room to room.
7. A feasibility study should be conducted on ancillary school facilities such as the sewage system, staff houses, etc.

C. Technical comments and recommendations

1. Now that the study of the standard building design for the small-sized school has been completed, the next logical step would be to analyze medium- and large-sized schools.
2. The administering of questionnaires and the organization of the seminar on physical facilities were very useful exercises having long-term impacts. High-level administrators recommended that these exercises should be carried out yearly involving different group of participants.
3. The analysis of the architectural design can be carried out more thoroughly on a special project basis rather than as a routine operation.
4. The exercise promoted a spirit of teamwork between administrators, educators, architects, engineers and civil works technicians.
5. The study produced an objective evaluation of existing buildings to find out about their advantages and disadvantages and how to improve upon them.

D. Comments and recommendations concerning further studies

1. Further studies should be conducted on the methods for developing safe water supplies and sewage systems that are adequate for schools with different enrolments.
2. A study should be carried out on the problems resulting from chalk dust to identify better alternatives for teachers.
3. A study should be conducted on the use of school sites to examine their optimal use, the provision of services and recreational zones, and how to cope with noise interference.
4. Consideration should be given to the question of whether or not staff should be appointed, who are responsible for the proper care and maintenance of the school buildings and premises.
5. Guidelines or handbooks for the proper use and care of the buildings and landscaping should be developed and made available to the schools.

6. Standard criteria should be developed for the selection of school sites that are suitable for development.
7. There should be a study prepared on the design of furniture suited to the requirements of specialized rooms and auxiliary facilities.
8. There should be a special study done on the architectural design for schools constructed on the mainland coast or on islands.

E. Closing remarks

The task force is grateful to the questionnaire respondents, seminar participants and to those who provided the information, which made this study possible and successful. The task force hopes that, upon completion of the prototype construction in Uthai Thani, it will receive further cooperation for the final step of the project evaluation.

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Annex A

Expenditure of Unesco Assistance

	Baht
1. Questionnaires	1,300
2. Study and analysis of existing buildings	18,000
3. Seminar	75,000
4. Translation	5,000
5. Printing	25,000
6. References	4,200
Total	128,500
(Equivalent US$ 5,000)	

Annex B

List of Secondary Schools Completing Questionnaires

	School	Province
1.	Khonhaad Prachasan	Nakhon Si Thamarat
2.	Pracha Bamrung	Phatalung
3.	Songkhwae Witayakhom	Chiangmai
4.	Plong Witayakhom	Chiangrai
5.	Bosak Witayakhan	Nan
6.	Phayalo Witayakhom	Phayao
7.	Soi Seri Witaya	Phrae
8.	Mae Lanoi "Darunsikh"	Mae Hong Son
9.	Maeta Prachasamakkhi	Lampang
10.	Champamong Wittayakhan	Udon Thani
11.	Traikham Witaya	Khon Kaen
12.	Chiangklom Witaya	Loei
13.	Tharae Suksa	Sakon Nakhon
14.	Ban Thai Witayakhom	Ubon Ratchathani
15.	Laoklang Witayakhom	Kalasin
16.	Cumcang Palangrat	Kalasin
17.	Wiangkham Witayakhan	Nongkhai
18.	Nakham Witaya	Ubon Ratchathani
19.	Samkha Sawang Witaya	Kalasin
20.	Phrasong Samakkhi Witaya	Nakhon Phanom
21.	Udomwit	Mukdahan
22.	Khawao Yai Pitayasan	Maha Sarakham
23.	Kheun Phitayasan	Maha Sarakham
24.	Kammaek Khantidham Witaya	Yasothon
25.	Phoklang Phitayakhom	Roi Et
26.	Nongphyng Witayakhan	Roi Et
27.	Pranthong Witaya	Nakhon Ratchasima
28.	Thachang Ratbamrung	Nakhon Ratchasima
29.	Kwangcon Suksa	Chaiyaphum

	School	Province
30.	Pry Yai Witaya Banlang	Si Sa Ket
31.	Worakhun Upatham	Si Sa Ket
32.	Sinarin Witaya	Surin
33.	Phamuang Witayakhom	Petchabun
34.	Lablaesi Witaya	Uttaradit
35.	Phayao Prasatwit	Phayao
36.	Thampin Witayakhom	Phayao
37.	Mae Jedi Witayakhom	Chiangrai
38.	Nongluang Suksa	Sakon Nakhon
39.	Naduang Witaya	Loei
40.	Namon Phitayakhom	Kalasin
41.	Tungteong Yingwatana	Ubon Ratchathani
42.	Sanom Witayakhan	Surin
43.	Thakham	Pattani
44.	Nabon	Nakhon Si Thamarat
45.	Jana Chanupatham	Songkhla
46.	Kanjanadit	Surat Thani
47.	Chongphran Witaya	Ratchaburi
48.	Banhan Jamsai Witaya 3	Suphanburi
49.	Mae Ramad Witayakhom	Tak
50.	Saklek Witaya	Phichit
51.	Chaiprakan	Chiangmai
52.	Borai Witayakhom	Trad
53.	Luangpo Pan "Klongdan Anusorn"	Samut Prakan
54.	Suanphyng Witaya	Ratchaburi
55.	Uthai	Phra Nakhon Si Ayutthaya
56.	Sangkhom Witaya	Udon Thani
57.	Kushi Narai	Kalasin
58.	Khokko Phitayakhom	Maha Sarakham
59.	Mahisara Thibodi	Nakhon Ratchasima
60.	Nakhon Silamduan Witaya	Si Sa Ket
61.	Nadi Witaya	Surin

	School	Province
62.	Surasak Witayakhom	Chonburi
63.	Paknam Chumphon Witaya	Chumphon
64.	Phrupi Phitayakhom	Surat Thani
65.	Kapong Phitayakhom	Phangnga
66.	Khoktum Witaya	Lopburi
67.	Muangklang Witayakhom	Petchabun
68.	Pasang	Lamphun
69.	Naklang Suksawit	Udon Thani
70.	Huai Khayung Witaya	Ubon Ratchathani
71.	Pyngdaed Witayakhan	Mukdahan
72.	Hua Thanon Witaya	Chonburi

List of Regional Education Offices Completing the Questionnaires

Regional Education Office 1
Regional Education Office 2
Regional Education Office 3
Regional Education Office 4
Regional Education Office 5
Regional Education Office 6
Regional Education Office 7
Regional Education Office 8
Regional Education Office 9
Regional Education Office 10
Regional Education Office 11
Regional Education Office 12

Annex C

Questionnaire

This questionnaire is part of the data collection phase of a study of prototype secondary school undertaken by the Design and Construction Division, Department of General Education. Your realistic answers will be useful for the study. The researchers will keep your answers confidential and will make use of them solely for the purpose of this study.

Thank you for your co-operation.

Directions for completion of the questionnaire

The questionnaire has two parts, namely:

Part 1 Contains questions on existing buildings and auxiliary facilities. Please express your views by putting a mark under an appropriate column. Write your additional comments in the space at the back of the questionnaire form.

Part 2 Contains questions about classroom building development conducive to better learning and teaching. In addition to indicating the answer reflecting your views, it would be helpful for building design development if you could also provide further comments or suggestions.

You may omit any question that is not relevant to your case.

Part 1 Questions concerning existing building(s). Please indicate the type(s) of building(s) already in existence in your school.

[ ] Type 208 Building (currently known as 108 L)
[ ] Type 316 Building (currently known as 216 L)
[ ] Building under LSS Project
[ ] Building Type ————————

Choose the one answer that agrees with your view for each statement.

Item	Good	Rather good	Fair	Needs to be improved
1. Classroom size 7.00 x 9.00 metres 8.00 x 8.00 metres				
2. Number of storeys Two Two, with open ground floor One, with open ground floor Other				
3. Classroom lighting Classroom (natural light) Specialized room (natural light) Other				
4. Ventilation				
5. Noise interference from adjacent rooms				
6. Corridor Suitable size Benches/seats				

Item	Good	Rather good	Fair	Needs to be improved
7. Ladders				
8. Staircase				
9. Height between storeys				
10. Density				
11. Teacher toilets				
12. Height of open ground floor				
13. Doors				
14. Windows				
15. Student desks and chairs				
16. Blackboard and bulletin board				
17. Shading (of reflection)				
18. Rain protection				
19. Suitability for general use				

Additional comments . . . . . .

. . . . . .

Your school has the following type(s) of workshop(s)

[ ] Type 102/27
[ ] LSS Project Type
[ ] Other type

Choose the one answer that agrees with your view for each statement.

Item	Good	Rather good	Fair	Needs to be improved
1. Workshop size				
2. Teacher room size				
3. Tool storage room				
4. Building height				
5. Shading				
6. Rain protection				
7. Lighting (natural light)				
8. Ventilation				
9. Noise interference in the building				
10. Doors				
11. Windows				
12. Placement of machines				
13. Blackboard and bulletin board				
14. Building floor (material used)				
15. General functional suitability				

Additional comments . . . . . .

. . . . . .

Part 2 Questionnaire on development of the building to facilitate better teaching and learning.

Please supply your school master plan.

Choose the one answer that agrees with your view for each statement.

Item	Good	Rather good	Fair	Needs to be improved
1. Complete separation of classroom building and auxiliary facilities				
2. Classroom building and auxiliary facilities are separate units but connected by pathway (students can move when it rains)				
3. Classroom building and auxiliary facilities form a single block (a U, O or L shape)				
4. Buildings are located in accordance with site and surrounding conditions				
5. Buildings should be arranged in rows and columns with the new building always in the front				
6. Master plan should be a product of consultation between the architect and the administrator				

Choose the one answer that agrees with your view for each statement.

Item	Good	Rather good	Fair	Needs to be improved
1. Classroom Size 8.00 x 8.00 sq. m. 7.00 x 9.00 sq. m. 6.00 x 8.00 sq. m. Size				
2. Corridor Width 2.00 metres Width 2.50 metres Width				
3. Corridor benches should be placed – throughout the corridor – here and there – not at all				
4. Height between storeys 3.50 metres 3.30 metres Depends on room size				
5. Staircase Width Rail Steepness				
6. Teacher toilets Width and length Their use Other				

Item	Good	Rather good	Fair	Needs to be improved
7. Ventilation				
There should be additional air vents at the corridor				
8. Glass				
Should not be used entirely (because of its fragility)				
Use glass for light only				
Other				
9. Building floor				
Polished concrete surface				
Rubber padded surface				
Polished stones				
Cement tiles				
Other				
10. Unwalled ground floor				
Is a must (multi-purpose)				
Should not be allowed to exist				
Should be allowed in accordance with topography				
Other opinion				
11. Student toilets				
Should be incorporated in the building block				
Should be separated from the classroom building				
Should be a separate unit(s) and suitably planned				
Other opinion				

Item	Definitely agree	Quite agree	Cannot decide	Disagree
12. Rain water				
There should gutters in all buildings				
There should be gutters in certain building				
No gutters are needed				
Other opinion				
13. Tanks for rain water				
Are integral parts of building				
Are separate parts				
Other opinion				
14. Blackboard				
Flat surface attached to the wall				
Convexed on both ends				
Tilted against reflection				
15. Windows				
Without panes (for classroom only)				
With open/close panes				
Adjustable angle (whitco-type)				
16. Doors				
Without panes (for classroom only)				
With panes				
Other opinion				
17. Materials in general				
Use materials as with existing buildings				
There should be some improvement				
Other opinion				

Floor plans for the various rooms.

Item	Definitely agree	Quite agree	Cannot decide	Disagree
1. Administrative and business room should be a confined area				
Regular classrooms only should be provided and then the school can make use of one of them by means of modification				
Other opinion				
2. Teacher room				
Should be provided adequately for the teachers				
Regular classrooms only should be provided and then the school can make use of one of them by means of modification				
Other opinion				
3. First aid room				
Should be suitably designed from the outset				
Can be converted from regular classroom(s)				
Other opinion				
4. Sport room				
Should be suitably designed from the outset				
Can be converted from regular classroom(s)				
Other opinion				

Item	Agree	Rather agree	Cannot decide	Disagree
5. Library				
Should be suitably designed from the outset				
Can be converted from regular classroom(s)				
Other opinion				

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Annex D

Seminar participation executive board

1. Deputy Director General Department of General Education	Chairman
2. Director of Secondary Schools Division	Member
3. Chief of Supervisory Unit	Member
4. Director of Planning Division	Member
5. Director of Design and Construction Division	Member
6. Director of Office of Special Projects	Member
7. Mr. Kriangsak Charanyanond	Member
8. Mr. Paiboon Chareonsuk	Secretary
9. Mr. Prasit Meesree	Ass. Secretary

Technical Committee

1. Mr. Wisit Duangsong
2. Mrs. Rasri Chantarangkoon
3. Mr. Banchong Pongsart
4. Mr. Kamtorn Boonpalit
5. Mr. Kriangkrai Pimolmas
6. Mr. Sawat Udompoch
7. Mr. Dhammanoon Wisaijorn

Participants

1. Kamol Thisopa
2. Banchong Pongsart
3. Kriangkrai Pimolmas
4. Sawat Udompoch
5. Kriangsak Charanyanond
6. Paiboon Chareonsuk
7. Prasit Meesree
8. Prasert Ahingsago
9. Kamtorn Boonpalit
10. Wisut Suwannet
11. Kriangkrai Sriwatanarotai
12. Dhamanoon Wisaijorn
13. Mrs. Rasri Chantarangul
14. Mrs. Supalak Hiranburana
15. Mrs. Walairat Sukwong
16. Mrs. Payao Buachan
17. Boonleu Sripichai
18. Wisit Duangsong
19. Thani Somboonburana
20. Tianchai Chantarawan
21. Tong-In Ngamsom
22. Chua Maichareon
23. Miss Kanitta Witaya-Anumas
24. Manit Sripitak
25. Surat Chiatrakul
26. Rangsit Manisri
27. Payoonsak Intanin
28. Pol Boonyou

Annex E. Seminar schedule

Day/ Date	8.30 – 10.30	10.45 – 12.00	13.00 – 15.00	15.15 – 16.30
Tuesday 8 Dec. 30	Opening: 10 min. Keynote lecture: Physical Facilities for Secondary Schools Kamon Thisopa Orientation: 15 min	Needs of small secondary schools: 60 min. Banchong Pongsart Discussion: 30 min	Budgeting and related problems: 45 min. Mrs. Rasri Chantarangul Discussion: 30 min	Towards improvement of existing buildings 30 min Kriangkrai Pimolmas Slides: 30 min Kriangkrai Sriwatanarotai Discussion: 30 min
Wednesday 9 Dec 30	Development of Prototype of Secondary School Project : 30 min Kriangsak Charanyanond Draft prototype: 30 min Kamtorn Boonpalit Problems based on questionnaire 30 min Paiboon Chareonsuk	Group Meeting Group 1: Chairman Banchong Pongsart Group 2: Chairman Kriangkrai Pimolmas	Group Meeting (continued) Group 1 Group 2	Group Reports Secretary Group 1 Secretary Group 2 Kamol Thisopa Closing ceremony

Annex F. Project task force

Chairman	:	Kriangsak Charanyanond Paiboon Chareonsuk Kamtorn Boonpalit Kriangkrai Sriwatanarotai Tianchai Chantarawan Wisut Suwannet Prasit Meesree Solot Labpit
Advisor	:	Kringkrai Pimolmas
Project Architects	:	Kamtorn Boonpalit Kriangkrai Sriwatanarotai
Project Engineer	:	Wisut Suwannet
Report prepared by	:	Kriangsak Charanyanond

Appendix 16

END

U.S. Dept. of Education

Office of Education
Research and
Improvement (OERI)

ERIC

Date Filmed

March 29, 1991